RECORDS

OF

THE GEOLOGICAL SURVEY OF INDIA,

VOL. LIX, PART 3.

1926.

CONTENTS.

Published by order of the Government of India.

CALCUTTA: GOVERNMENT OF INDIA
CENTRAL PUBLICATION BRANCH
1926

Price Rs. 2-12 or 5s.

MEMOIRS OF THE GEOLOGICAL SURVEY OF INDIA

VOL. I. Pt. 1, 1856 (*out of print*) (*price* 1 Re.) : Coal and Iron of Talchir.—Talchir Coal field—Gold yielding deposits of Upper Assam—Gold from Shué gween Pt 2, 1858 (*out of print*) (*price* 2 Rs) : Geological structure of a portion of Khasi Hills—Geological structure of Nilgiri Hills (Madras). Pt. 3, 1859 (*out of print*) (*price* 2 Rs.) Geological structure and physical features of districts of Bankura, Midnapore, and Orissa—Laterite of Orissa—Fossil fish teeth of genus *Ceratodus*, from Mudeli, south of Nagpur.

VOL. II. Pt 1, 1859 (*out of print*) (*price* 2 Rs) : Vindhyan rocks, and their associates in Bundelkhand Pt. 2, 1860 (*out of print*) (*price* 3 Rs.) : Geological structure of central portion of Nerbudda District.—Tertiary and alluvial deposits of central portion of Nerbudda Valley.—Geological relations and probable age of systems of rocks in Central India and Bengal.

VOL. III. Pt. 1, 1861 (*out of print*) (*price* 3 Rs) : Raniganj Coal-field.—Additional remarks on systems of rocks in Central India and Bengal—Indian Mineral Statistics, I Coal Pt 2, 1864 (*out of print*) (*price* 2 Rs) : Sub Himalayan Ranges between Ganges and Ravi

VOL. IV. Pt 1, 1862 (*out of print*) (*price* 2 Rs) . Cretaceous Rocks of Trichinopoly District, Madras Pt 2, 1864 (*out of print*) (*price* 2 Rs) : Districts of Trichinopoly, Salem, etc Pt 3, 1865 (*out of print*) (*price* 1 Re) Coal of Assam, etc

VOL. V. Pt. 1, 1865 (*out of print*) (*price* 3 Rs) : Sections across N.-W. Himalaya, from Sutlej to Indus—Gypsum of Spiti Pt 2, 1866 (*out of print*) (*price* 1 Re) Geology of Bombay Pt 3, 1866 (*out of print*) (*price* 1 Re) . Jheria Coal field—Geological Observations on Western Tibet

VOL. VI Pt. 1, 1867 (*price* 8 As) . Neighbourhood of Lynyan, etc, in Sind.—Geology of portion of Cutch Pt 2, 1867, Rej 1868 and 1921 (*price* 2 Rs) Bokaro Coal field—Ramgarh Coal field Traps of Western and Central India Pt 3, 1869 (*price* 2 Rs 8 As) Tapti and Nerbudda Valleys Trap beds in Bombay—*Oxytropis spatilla*

VOL. VII Pt 1 1869 (*price* 3 Rs) Vindhyan series- Mineral Statistics : Coal—[illegible] Pt 2 1870 (*out of print*) (*price* 1 Re) Kathurbani Coal field Deogini Coal field Pt 3, 1871 (*out of print*) (*price* 1 Re) Aden water supply Kalanpura Coal fields

VOL. VIII Pt 1, 1872 (*price* 4 Rs) Kadapah and Karnul Formations in Madras Pranhita-Godavari Valley (*out of print*) *price* 1 Re Jhikuri Coal field—Deogani Coal field—Chope Coal field

VOL. IX Pt 1, 1872 (*price* 4 Rs) Geology of Kutch Pt 2, 1872 (*price* 1 Re) Geology of Nagpur—Geology of Sirban Hill—Carboniferous Ammonites

VOL. X. Pt 1, 1873 (*price* 3 Rs) Geology of Madras—Satpura Coal basin Pt 2, 1873 (*out of print*) (*price* 2 Rs) Geology of Pegu

VOL XI Pt 1, 1874 (*price* 2 Rs) Geology of Darjiling and Western Duars Pt 2, 1875 (*price* 3 Rs) Salt region of Kohat, Trans Indus

VOL. XII. Pt 1 1876 (*price* 3 Rs) South Mahratta Country Pt 2, 1876 (*price* 2 Rs) Coal fields of Naga Hills

VOL XIII Pt 1, 1877 (*price* 2 Rs 8 As) Wardha Valley Coal field Pt. 2, 1877 (*price* 2 Rs 8 As) Geology of Rajmahal Hills

VOL XIV 1878 (*price* 5 Rs) Geology of Salt range in Punjab

VOL XV Pt 1, 1879 (*out of print*) (*price* 2 Rs 8 As) Amungi and Hutár Coal fields (Palamow) Pt 2, 1880 (*price* 2 Rs 8 As) : Ramkola and Tatapani Coal fields (Surguja)

VOL XVI Pt 1, 1879 (*price* 1 Re 8 As) : Geology of Eastern Coast from Lat. 15° to Masulipatam Pt 2 1880 (*price* 1 Re. 8 As) : Nellore Portion of Carnatic Pt 3, 1880 (*price* 2 Rs.) : Coastal Region of Godávari District.

VOL. XVII. Pt. 1, 1879 (*price* 3 Rs.) : Geology of Western Sind. Pt. 2, 1880 (*price* 2 Rs.) : Trans-Indus extension of Punjab Salt-range.

VOL. XVIII. Pt. 1, 1881 (*out of print*) (*price* 2 Rs.) : Southern Afghanistan. Pt. 2, 1881 (*out of print*) (*price* 1 Re. 8 As.) : Mánbhum and Singhbhum Pt. 3, 1881 (*out of print*) (*price* 2 Rs.) : Pránhita-Godavári Valley.

VOL. XIX. Pt. 1, 1882 (*price* 2 Rs.) : Cachar Earthquake of 1869. Pt. 2, 1882 (*out of print*) (*price* 1 Re.) : Thermal Springs of India. Pt. 3, 1883 (*price* 1 Re) : Catalogue of Indian Earthquakes. Pt. 4, 1883 (*out of print*) (*price* 1 Re.) : Geology of parts of Manipur and Naga Hills.

VOL. XX. Pt. 1, 1883 (*out of print*) (*price* 2 Rs. 8 As.) : Geology of Madura and Tinnevelly. Pt. 2, 1883 (*out of print*) (*price* 2 Rs 8 As.) : Geological notes on Hills in neighbourhood of Sind and Punjab Frontier between Quetta and Dera Ghazi Khan.

VOL. XXI. Pt. 1, 1884 (*out of print*) (*price* 2 Rs) : Geology of Lower Narbada Valley. Pt. 2, 1885 (*out of print*) (*price* 1 Re.) : Geology of Kathiawar. Pt. 3, 1885, Rep. 1925 (*price* 6 Rs. 14 As.) : Coal-fields of South Rewah. Pt. 4, 1885 (*out of print*) (*price* 1 Re.) : Barren Island.

VOL. XXII. 1883 (*out of print*) (*price* 5 Rs.) : Geology of Kashmir, Chamba and Khagan.

VOL XXIII. 1891 (*price* 5 Rs.) : Geology of Central Himalayas.

VOL. XXIV. Pt. 1, 1887 (*price* 1 Re. 8 As.) : Southern Coal fields of Sátpur Gondwána basin. Pt. 2, 1890 (*out of print*) (*price* 2 Rs. 4 As.) : Geology of Sub-Himalaya of Garhwal and Kumaon. Pt. 3, 1890 (*out of print*) (*price* 1 Re. 4 As.) : Geology of South Malabar, between Beypore and Ponnáni Rivers

VOL. XXV. 1895 (*out of print*) (*price* 5 Rs.) : Geology of Bellary District, Madras Presidency.

VOL. XXVI. 1896 (*out of print*) (*price* 5 Rs.) : Geology of Hazara.

VOL. XXVII. Pt 1, 1895 (*out of print*) (*price* 1 Re) : Marine Fossils from Miocene of Upper Burma. Pt. 2, 1897 (*out of print*) (*price* 4 Rs) : Petroleum in Burma and its technical exploitation.

VOL XXVIII. Pt 1. 1898 (*out of print*) (*price* 2 Rs) : Geological Structure of Chitichun region —Allahbund in north-west of Rann of Kuchh.— Geology of parts of Myingyan, Magwe and Pakokku Districts, Burma —Geology of Mikir Hills in Assam.—Geology of Tirah and Bazar Valley. Pt. 2, 1900 (*price* 3 Rs.) : Charnockite Series, group of Archæan Hypersthenic Rocks in Peninsular India

VOL. XXIX. 1900 (*price* 5 Rs) : Earthquake of 12th June 1897.

VOL. XXX. Pt. 1, 1900 (*price* 2 Rs) : Aftershocks of Great Earthquake of 12th June 1897. Pt 2, 1900 (*price* 1 Re) : Geology of neighbourhood of Salem, Madras Presidency. Pt. 3, 1901 (*price* 1 Re) : Sivamalai Series of Elæolite Syenites and Corundum Syenites. Pt. 4, 1901.

VOL XXXI. Pt. 1, 1901 (*out of print*) (*price* 2 Rs) : Geology of Son Valley in Rewah State and of Parts of Jabalpur and Mirzapur Pt 2, 1901 (*price* 3 Rs) : Baluchistan Desert and part of Eastern Persia. Pt. 3, 1901 (*price* 1 Re.) . Peridotites, Serpentines, etc., from Ladakh.

VOL. XXXII. Pt. 1, 1901 (*price* 1 Re.) : Recent Artesian Experiments in India. Pt 2, 1901 (*price* 2 Rs) : Rampur Coal-field. Pt. 3, 1902 (*price* 3 Rs) : "Exotic Blocks" of Malla Johar in Bhot Mahals of Kumaon Pt 4, 1904 (*price* 3 Rs) : Jammu Coal-fields.

VOL. XXXIII. Pt. 1, 1901 (*price* 8 Rs.) : Kolar Gold-field. Pt. 2, 1901 (*price* 2 Rs) : Art. 1 : Gold fields of Wainád. Art. 2 : Auriferous Quartzites of Parhadiah, Chota Nagpur Art 3. Auriferous localities in North Coimbatore. Pt. 3, 1902 (*price* 1 Re.) : Geology of Kalahandi State, Central Provinces

VOL. XXXIV. Pt. 1, 1901 (*price* 1 Re.) : Peculiar form of altered Peridotite in Mysore State. Pt. 2, 1902 (*out of print*) (*price* 3 Rs) : Mica deposits of India. Pt. 3, 1903 (*price* 1 Re.) : Sandhills of Clifton near Karachi. Pt. 4, 1908 (*price* 4 As.) : Geology of Persian Gulf and adjoining portions of Persia and Arabia.

VOL. XXXV. Pt. 1, 1902 (*out of print*) (*price* 2 Rs.) : Geology of Western Rajputana. Pt 2, 1903 (*price* 1 Re.) : Aftershocks of Great Earthquake of 12th June 1897. Pt. 3, 1904 (*out of print*) (*price* 1 Re) : Seismic phenomena in British India and their connection with its Geology. Pt. 4, 1911 (*price* 1 Re.) : Geology of Andaman Islands, with reference to Nicobars

VOL. XXXVI. Pt. 1, 1904 (*price* 4 Rs.) : Geology of Spiti. Pt. 2, 1907 (*price* 3 Rs.) : Geology of Provinces of Tsang and U in Central Tibet. Pt. 3, 1919 (*price* 3 Rs.) : Trias of the Himalayas.

VOL. XXXVII. 1909 (*price of complete volume* 8 Rs.) : Manganese-Ore Deposits of India : Pt 1 (*out of print*) (*price* 3 Rs.), Introduction and Mineralogy; Pt. 2 (*out of print*) (*price* 3 Rs.), Geology; Pt. 3 (*out of print*) (*price* 3 Rs), Economics and Mining; Pt. 4 (*out of print*) (*price* 5 Rs.), Description of Deposits

VOL. XXXVIII 1910 (*price* 5 Rs.) : Kangra Earthquake of 4th April 1905.

VOL. XXXIX. Pt. 1, 1911 (*price* 2 Rs) : Geology of Northern Afghanistan. Pt. 2, 1913 (*price* 3 Rs.) : Geology of Northern Shan States.

VOL. XL Pt. 1, 1912 (*out of print*) (*price* 5 Rs.) : Oil Fields of Burma. Pt. 2, 1914 (*price* 3 Rs) : Petroleum Occurrences of Assam and Bengal. Pt. 3, 1920 (*out of print*) (*price* 5 Rs.) : Petroleum in the Punjab and North West Frontier Province.

VOL XLI. Pt. 1, 1913, Rep. 1922 (*price* 5 Rs.) : Coal-fields of India. Pt. 2, 1914 (*price* 3 Rs) : Geology and Coal Resources of Korea State, Central Provinces.

VOL. XLII. Pt. 1, 1914 (*price* 3 Rs.) : Burma Earthquakes of May 1912. Pt. 2, 1917 (*price* 3 Rs) : The structure of the Himalayas and the Gangetic Plain.

VOL XLIII. Pt 1, 1913 (*out of print*) (*price* 2 Rs) : Indian Geological Terminology Pt 2, 1916 (*price* 1 Re.) . Catalogue of Meteorites in the collection of the Geological Survey of India, Calcutta

VOL. XLIV. Pt. 1, 1921 (*price* 5 Rs.) : Geology of Idar State. Pt. 2, 1923 (*price* 6 Rs 8 As) : Geology and Ore Deposits of Tavoy.

VOL XLV. Pt. 1, 1917 (*price* 3 Rs.) : Geology of North-Eastern Rajputana and adjacent districts. Pt 2, 1922 (*price* 3 Rs.) : Gwalior and Vindhyan Systems in South Eastern Rajputana

VOL XLVI Pt 1, 1920 (*price* 4 Rs) : Sumangal Earthquake of 8th July 1918. Pt. 2, 1926 (*price* 2 Rs) The Cutch (Kachh) Earthquake of 16th June 1819 with a Revision of the Great Earthquake of 12th June 1897.

VOL. XLVII. Pt. 1, 1920 (*price* 3 Rs) : Mines and Mineral Resources of Yunnan. Pt. 2, 1923 (*price* 4 Rs) : The Alkaline Lakes and the Soda Industry of Sind

VOL. XLVIII. Pt. 1, 1922 (*price* 5 Rs) : Geological Notes on Mesopotamia with special references to Occurrences of Petroleum. Pt. 2, 1925 (*price* 3 Rs 12 As) : Geology of Parts of the Persian Provinces of Fars, Kerman and Laristan

VOL XLIX. Pt 1, 1923 (*price* 5 Rs 8 As) The Bauxite and Aluminous Laterite occurrences of India

VOL L Pt 1, 1925 (*price* 5 Rs 6 As) : Descriptions of Molluscs of the Post-Eocene Tertiary formation of North Western India. Pt 2 (*in the press*) The Geology of Poonch State (Kashmir) and Adjacent Portions of the Punjab

VOL. LI. Pt 1, 1925 (*price* 3 Rs 8 As) . Indian Geological Terminology.

VOL LII Pt. 1, 1925 (*price* 7 Rs. 8 As.) : On the Geological Structure of the Karanpura Coalfields, Bihar and Orissa.

Contents and index to Memoirs, Vols I-XX and Vols. XXI-XXXV. Price 1 rupee each.

PALÆONTOLOGIA INDICA

(Ser. I, III, V, VIII.)—CRETACEOUS FAUNA OF SOUTHERN INDIA, ZKA, *except* Vol. I, Pt. 1, *by* H. F. BLANFORD.

Ser. I & III.—Vol. I. The Cephalopoda (1861—65), pp. 216, pls. 94 (6 double) (*out of print*).

V.—Vol. II. The Gastropoda (1867—68), pp. xiii, 500, pls. 28 (*out of print*).

VI.—Vol. III. The Pelecypoda (1870—71), pp. xxii, 537, pls. 50.

VIII.—Vol. IV. The Brachiopoda, Ciliopoda, Echinodermata, Corals, etc. (1872—73), pp. v, 202, pls. 29.

(Ser. II, XI, XII.)—THE FOSSIL FLORA OF THE GONDWANA SYSTEM, *by* O. FEISTMANTEL, *except* Vol. I, Pt. 1, *by* T. OLDHAM and J. MORRIS.

Vol. I, pp. xviii, 233, pls. 72. 1863-79. Pt. 1 (*out of print*). Rájmahál Group, Rajmahal Hill. Pt. 2. *The same* (*continued*). Pt. 3. Plants from Golapilli. Pt. 4: Outliers on the Madras Coast.

Vol. II, pp. xli, 115, pls. 26. 1876-78. Pt. 1: Jurassic Flora of Kach. Pt. 2: Flora of the Jabalpur group.

Vol. III, pp. xi, 64+149, pls. 80 (9 double) (I—XXXI+IA—XLVIIA). 1879-81. Pt. 1: The Flora of the Talchir-Karharbari beds. Pt. 2: The Flora of the Damuda and Panchet Divisions. Pt. 3: *The same* (*concluded*).

Vol. IV, pp. xxv., 25+66, pls. 35 (2 double) (I—XXI+IA—XIVA). Pt. 1 (1882) (*out of print*). Fossil Flora of the South Rewah Gondwana basin. Pt. 2 (1886): Fossil Flora of some of the coal-fields in Western Bengal.

(Ser. IX.)—JURASSIC FAUNA OF KUTCH.

Vol. I (1873-76). The Cephalopoda, pp. i, 247, pls. 60 (6 double), by W. WAAGEN.

Vol. II, pt. 1 (1893). The Echinoidea of Kach, pp. 12, pls. 2, by J. W. GREGORY (*out of print*).

Vol. II, pt. 2 (1900). The Corals, pp. 196, I—IX, pls. 26, by J. W. GREGORY.

Vol. III, pt. 1 (1900). The Brachiopoda, pp. 87, pls. 15, by F. L. KITCHIN.

Vol. III, pt. 2 (1903). Lamellibranchiata: Genus Trigonia, pp. 122, pls. 10, by F. L. KITCHIN.

(Ser. IV.)—INDIAN PRE-TERTIARY VERTEBRATA.

Vol. I, pp. vi, 137, pls. 26. 1865-85. Pt. 1 (1865): The Vertebrate Fossils from the Panchet rocks, by T. H. HUXLEY. Pt. 2 (1878): The Vertebrate Fossils of the Kota-Maleri Group, by SIR P. DE M. GREY EGERTON, L. C. MIALL, and W. T. BLANFORD. Pt. 3 (1879): Reptilia and Batrachia, by R. LYDEKKER. Pt. 4 (1885): The Labyrinthodont from the Bijori group, by R. LYDEKKER. Pt. 5 (1885): The Reptilia and Amphibia of the Maleri and Denwa groups, by R. LYDEKKER.

(Ser. X.)—INDIAN TERTIARY AND POST-TERTIARY VERTEBRATA, *by* R. LYDEKKER, *except* Vol. I, Pt. 1, *by* R. B. FOOTE.

Vol. I, pp. xxx, 300, pls. 50. 1874-80. Pt. 1. Rhinoceros deccanensis. Pt. 2: Molar teeth and other remains of Mammalia. Pt. 3: Crania of Ruminants. Pt. 4: Supplement to Pt. 3. Pt. 5. Siwalik and Narbada Proboscidia.

Vol. II, pp. xv, 363, pls. 45. 1881-84. Pt. 1: Siwalik Rhinocerotidæ. Pt. 2: Supplement to Siwalik and Narbada Proboscidia. Pt. 3: Siwalik and Narbada Equidæ. Pt. 4: Siwalik Camelopardalidæ. Pt. 5: Siwalik Selenodont Suina, etc. Pt. 6: Siwalik and Narbada Carnivora.

Vol. III, pp. xxiv, 264, pls. 1884-86. Pt. 1 (*out of print*). Additional Siwalik Perissodactyla and Proboscidia. Pt. 2 (*out of print*). Siwalik and Narbada Bunodont Suina. Pt. 3 (*out of print*): Rodents and new Ruminants from the Siwaliks. Pt. 4 (*out of print*): Siwalik Birds. Pt. 5 (*out of print*): Mastodon Teeth from Perim Island. Pt. 6 (*out of print*): Siwalik and Narbada Chelonia. Pt. 7 (*out of print*): Siwalik Crocodilia, Lacertilia and Ophidia. Pt. 8 (*out of print*): Tertiary Fishes.

Vol. IV, pt. 1 (*out of print*), 1886, pp. 18, pls. 5. Siwalik Mammals (Supplement).

Vol. IV, pt. 2 (*out of print*), 1886, pp. 40 (19—58), pls. 5 (vii—xi). The Fauna of the [illegible] caves [illegible] to pt. 1).

Vol. IV, pt. 3 (*out of print*), 1887, pp. 7 (59-65), pls. 2 (xii—xiii). Eocene Chelonia from [illegible].

(Ser. VII, XIV.)—TERTIARY AND UPPER CRETACEOUS FAUNA OF WESTERN INDIA, *by* P. MARTIN DUNCAN *and* W. PEROY SLADEN, *except* Pt. 1, *by* F. STOLICZKA

Vol. I, pp. 16+116+482+91=599, pls. 5+28+58+13=104. 1871-85. Pt. 1 (*out of print*): Tertiary Crabs from Sind and Kach. Pt. 1 (new 2): Sind Fossil Corals and Alcyonaria; by P. Martin Duncan Pt. 3: The Fossil Echinoidea of Sind: *Fas. 1, The Cardita beaumonti* beds; *Fas. 2*, The Ranikot Series in Western Sind, *Fas. 3*, The Khirthar Series; *Fas. 4*, The Nari (Oligocene) Series; *Fas. 5*, The Gaj (Miocene) Series; *Fas. 6*. The Makrán (Pliocene) Series; by Duncan and Sladen. Pt. 4: The Fossil Echinoides of Kach and Kattywar; by Duncan, Sladen and Blanford.

(Ser. XIII.)—SALT-RANGE FOSSILS, *by* WILLIAM WAAGEN, Ph.D.

Productus Limestone Group: Vol. I, Pt 1 (1879). Pisces, Cephalopoda, pp. 72, pls. 5.
" " " " 2 (1880) Gastropoda and supplement to pt. 1 pp 111 (73—183), pls. 10 (1 double), (vii—xvi).
" " " " 3 (1881). Pelecypoda, pp. 144 (185—328), pls. 8 (xvii—xxiv).
" " " " 4 (1882—85). Brachiopoda, pp. 442 (329—770), pls 62 (xxv—lxxxvi).
" " " " 5 (1885). Bryozoa—Annelidæ—Echinodermata, pp 64 (771—834), pls. 10 (lxxxvii—xcvi).
" " " " 6 (1886) Coelenterata, pp. 90 (835—924), pls. 20 (xcvii—cxvi).
" " " " 7 (1887) Coelenterata, Protozoa, pp. 74 (925-998), pls. 12 (cxvii—cxxviii).

Fossils from the Ceratite Formation: Vol. II, pt 1 (1895). Pisces—Ammonoidea, pp. 324, pls 40 (*out of print*)

Geological Results: Vol. IV, pt. 1 (1889), pp 1—88, pls 4 (*out of print*).
" " " " " 2 (1891), pp 89—242, pls 8

(Ser. XV.)—HIMALAYAN FOSSILS.

Upper triassic and liassic faunæ of the exotic blocks of Malla Johar in the Bhot Mahals of Kumaon: Vol. I, pt. 1 (1908), pp. 100, pls 16 (1 double), by Dr C. Diener.

Anthracolithic Fossils of Kashmir and Spiti: Vol. I, pt. 2 (1899), pp. 96, pls. 8, by Dr. C. Diener.

The Permocarboniferous Fauna of Chitichun No. I: Vol. I, pt 3 (1897), pp. 105, pls. 13, by Dr C Diener

The Permian Fossils of the Productus Shales of Kumaon and Garhwal: Vol. I, pt 4 (1897), pp 54, pls 5, by Dr C. Diener

The Permian Fossils of the Central Himalayas. Vol I, pt 5 (1903), pp 204, pls 10, by Dr C Diener

The Cephalopoda of the Lower Trias Vol II pt 1 (1897), pp. 182, pls 23, by Dr C. Diener.

The Cephalopoda of the Muschelkalk Vol II, pt 2 (1895), pp 118, pls. 31, by Dr. C Diener

Upper Triassic Cephalopoda Faunæ of the Himalaya: Vol. III, pt. 1 (1899), pp. 157, pls 22, by Dr E von Mojsisovics.

Trias Brachiopoda and Lamellibranchiata: Vol. III, pt. 2 (1899), pp. 76, pls. 12 (2 double), by Alexander Bittner.

The Fauna of the Spiti Shales: Vol IV. Cephalopoda: Fasc. 1 (1903), pp. 132, pls. 18; Fasc 2 (1910), pp. 133—306, pls. 47 (2 double); Fasc. 3 (1910), pp. 307—395 pls. 32; by Dr V Uhlig Lamellibranchiata and Gastropoda: Fasc. 4 (1913), pp 397—456, pls. 7; by Dr. K Holdhaus Additional Notes on the Fauna of the Spiti Shales: Fasc. 5 (1914), pp 457—511, pls 4; by Miss Paula Steiger, Ph D.

The Fauna of the Tropites-Limestone of Byans: Vol. V, Memoir No. 1 (1905), pp. 201, pls. 17 (1 double), by Dr. C Diener

The Fauna of the Himalayan Muschelkalk: Vol V, Memoir No. 2 (1907), pp. 140, pls. 17 (2 double), by Dr. C Diener

Ladinic, Carnic and Noric faunæ of Spiti: Vol V, Memoir No 3 (1908), pp. 157, pls. 24 (3 double), by Dr. C. Diener.

Lower Triassic Cephalopoda from Spiti, Malla Johar and Byans: Vol. VI, Memoir, No. 1 (1908), pp. 186, pls. 31, by Drs. A. von Kraft and C. Diener.

The Fauna of the Traumatocrinus Limestone of Painkhanda: Vol. VI, Memoir No. 2 (1909), pp. 39, pls. 5, by Dr. C Diener.

The Cambrian Fossils of Spiti: Vol. VII, Memoir No. 1 (1910), pp. 70, pls. 5, by F. R. C Reed.

Ordovician and Silurian fossils from the Central Himalayas: Vol. VII, Memoir No. 2 (1912), pp. 160, pls 20, by F. R. C. Reed.

(Ser. XVI.)—BALUCHISTAN FOSSILS, *by* FRITZ NOETLING, Ph.D., F.G.S.

The Fauna of the Kellaways of Mazár Drik: Vol. I, pt 1 (1895), pp. 22, pls. 13.

The Fauna of the (Neocomian) Belemnite Beds: Vol. I, pt. 2 (1897), pp. 4, pls. 3.

The Fauna of the Upper Cretaceous (Maëstrichtien) Beds of the Mari Hills: Vol. I, pt. 3 (1897), pp. 79, pls. 23.

The price fixed for these publications is four annas per single plate, with a minimum charge of Re. 1.

The Cambrian Fauna of the Eastern Salt-range: Vol. I, Memoir 1 (1899), pp. 14, pl. 1, by E. Redlich. Price 1 Re.

Notes on the Morphology of the Pelecypoda: Vol. I, Memoir 2 (1899), pp. 58, pls. 4, by Dr. Fritz Noetling. Price 1 Re. 4 As.

Fauna of the Miocene Beds of Burma: Vol. I, Memoir 3 (1901), pp. 378, pls. 25, by Dr. Fritz Noetling. Price 6 Rs. 4 As. (*out of print*).

Observations sur quelques Plantes Fossiles des Lower Gondwanas: Vol. II, Memoir 1 (1902), pp. 39, pls. 7, by R. Zeiller. Price 1 Re. 12 As.

Permo-Carboniferous Plants and Vertebrates from Kashmir: Vol. II, Memoir No. 2 (1905), pp. 13, pls. 3, by A. C. Seward and Dr. A. Smith Woodward. Price 1 Re.

The Lower Palæozoic Fossils of the Northern Shan States, Upper Burma: Vol. II, Memoir No. 3 (1906), pp. 154, pls. 8, by F. R. C. Reed. Price 2 Rs.

The Fauna of the Napeng Beds or the Rhætic Beds of Upper Burma: Vol. II, Memoir No. 4 (1908), pp. 88, pls. 9, by Miss M. Healey. Price 2 Rs. 4 As.

The Devonian Faunas of the Northern Shan States: Vol II, Memoir No. 5 (1908), pp 183, pls. 20, by F. R. C. Reed. Price 5 Rs.

The Mollusca of the Ranikot Series: Vol III, Memoir No. 1 (1909), pp xix, 83, pls 8, by M. Cossman and G. Pissarro Introduction, by E W Vredenburg Price 2 Rs.

The Brachiopoda of the Namyau Beds, Northern Shan States, Burma: Vol. III, Memoir No. 2 (1917), pp 254, pls 21, by S S Buckman Price 5 Rs 4 As.

On some Fish-remains from the Beds of Dongargaon, Central Provinces Vol III, Memoir No 3 (1909), pp 6, pl. 1, by Dr A Smith Woodward. Price 1 Re

Anthracolithic Fossils of the Shan States: Vol. III, Memoir No. 4 (1911), pp 74, pls 7 by Dr. C Diener. Price 1 Re. 12 As

The Fossil Giraffidæ of India: Vol. IV, Memoir No. 1 (1911), pp. 29, pls. 5, by Dr. G E. Pilgrim. Price 1 Re 4 As.

The Vertebrate Fauna of the Gaj Series in the Bugti Hills and the Punjab: Vol IV, Memoir No 2 (1912), pp. 83, pls. 30, and map, by Dr. G E Pilgrim Price 8 Rs

Lower Gondwana Plants from the Golabgarh Pass, Kashmir: Vol. IV, Memoir No 3 (1912), pp. 10, pls 3, by A C Seward Price 1 Re

Mesozoic Plants from Afghanistan and Afghan-Turkistan: Vol. IV, Memoir No 4 (1912), pp 57, pls. 7, by A C Seward Price 1 Re. 12 As.

Triassic Faunæ of Kashmir: Vol V, Memoir No. 1 (1913), pp. 133, pls. 13, by Dr. C Diener. Price 3 Rs. 4 As

The Anthracolithic Faunæ of Kashmir, Kanaur and Spiti: Vol. V, Memoir No 2 (1915), pp 135, pls 11, by Dr C Diener Price 2 Rs 12 As

Le Crétacé at l'Eocéne du Tibet Central: Vol. V, Memoir No. 3 (1916), pp 52, pls 16, by Prof, Henri Douvillé. Price 4 Rs

Supplementary Memoir on New Ordovician and Silurian fossils from the Northern Shan States · Vol VI, Memoir No 1 (1915), pp 98 pls 12, by F R C. Reed Price 3 Rs

Devonian Fossils from Chitral and the Pamirs · Vol VI, Memoir No 2 (1922), pp. 136, pls. 16, by F. R. C. Reed. Price 4 Rs

Ordovician and Silurian Fossils from Yunnan · Vol VI, Memoir No 3 (1917), pp 69, pls 8, by F R C Reed. Price 2 Rs.

Upper Carboniferous Fossils from Chitral and the Pamirs: Vol. VI, Memoir No 4 (1925), pp 134, pls 10, by F R C Reed Price 9 Rs 13 As

Indian Gondwana Plants: A Revision: Vol. VII, Memoir No. 1 (1920), pp. 41, pls. 7, by A. C. Seward and B. Sahni. Price 1 Re. 12 As

The Lamellibranchiata of the Eocene of Burma, Vol. VII, Memoir No 2 (1923), pp. 24, pls 7, by Dr G. de P Cotter Price 3 Rs. 10 As

Review of the Genus Gisortia: Vol VII, Memoir No 3 (*in the press*).

An incomplete skull of Dinotherium with notes on the Indian forms: Vol VII, Memoir No 4 (1924), pp. 13, pls 3, by R W. Palmer. Price 1 Re 2 As.

Contributions to the Palæontology of Assam: Vol VIII, Memoir No 1 (1923), pp 73, pls 4, by Erich Spengler Price 5 Rs.

The Anthracotheriidæ of the Dera Bugti deposits in Baluchistan: Vol VIII, Memoir No. 2 (1924), pp. 59, pls. 7, by C Forster Cooper Price 4 Rs.

The Perissodactyla of the Eocene of Burma · Vol. VIII, Memoir No 3 (1925), pp 28 pls. 2, by Dr. G. E Pilgrim. Price 1 Re. 9 As.

The Fossil Suidæ in India · Vol VIII, Memoir No 4 (1926), pp 65, pls 20, by Dr G. E Pilgrim Price 11 Rs 12 As

On the Blake Collection of Ammonites from Kachh: Vol. IX, Memoir No. 1 (1924), pp. 29, by L. F. Spath. Price 12 As

Revision of the Jurassic Cephalopod Fauna of Kachh: Vol IX, Memoir No 2 (*in the press*), by L. F. Spath

Palæozoic and Mesozoic Fossils from Yunnan: Vol. X, Memoir No. 1 (*in the press*), by F. R. C. Reed.

The Mollusca of the Ranikot Series (together with some species from the Cardita Beaumonti Beds: Vol. X, Memoir 2 (*in the press*), by M Cossman and G Pissaro.

Index to the Genera and Species described in the Palæontologia Indica, up to the year 1891. Price 1 rupee.

RECORDS OF THE GEOLOGICAL SURVEY OF INDIA.

VOL. I, 1868.

Part 1 (*out of print*).—Annual report for 1867. Coal-seams of Tawa valley. Coal in Garrow Hills. Copper in Bundelkund. Meteorites.

Part 2 (*out of print*).—Coal-seams of neighbourhood of Chanda. Coal near Nagpur. Geological notes on Surat Collectorate. Cephalopodous fauna of South Indian cretaceous deposits. Lead in Raipur district. Coal in Eastern Hemisphere. Meteorites.

Part 3 (*out of print*).—Gastropodous fauna of South Indian cretaceous deposits. Notes on route from Poona to Nagpur *viâ* Ahmednuggur, Jalna, Loonar, Yeotmahal, Mangali and Hingunghat. Agate-flake in pliocene (?) deposits of Upper Godavery Boundary of Vindhyan series in Rajputana. Meteorites.

VOL. II, 1869.

Part 1 (*out of print*).—Valley of Poorna river, West Berar. Kuddapah and Kurnool formations. Geological sketch of Shillong plateau. Gold in Singhbhoom, etc. Wells at Hazareebagh. Meteorites.

Part 2 (*out of print*).—Annual report for 1868. Pangshura tecta and other species of Chelonia from newer tertiary deposits of Nerbudda valley. Metamorphic rocks of Bengal.

Part 3 (*out of print*).—Geology of Kutch, Western India. Geology and physical geography of Nicobar Islands.

Part 4 (*out of print*).—Beds containing silicified wood in Eastern Prome, British Burma. Mineralogical statistics of Kumaon division. Coal-field near Chanda. Lead in Raipur district. Meteorites.

VOL. III, 1870.

Part 1 (*out of print*).—Annual report for 1869. Geology of neighbourhood of Madras. Alluvial deposits of Irrawadi, contracted with those of Ganges.

Part 2 (*out of print*).—Geology of Gwalior and vicinity. States at Chiteli, Kumaon. Lead vein near Chicholi, Raipur district. Wardha river coal-fields, Berar and Central Provinces. Coal at Karba in Bilaspur district.

Part 3 (*out of print*).—Mohpani coal-field. Lead-ore at Slimanabad, Jabalpur district. Coal east of Chhattisgarh between Bilaspur and Ranchi. Petroleum in Burma. Petroleum locality of Sudkal, near Futtijung, west of Rawalpindi. Argentiferous galena and copper in Manbhum. Assays of iron ores.

Part 4 (*out of print*).—Geology of Mount Tilla, Punjab. Copper deposits of Dalbhum and Singhbhum: 1.—Copper mines of Singhbhum: 2.—Copper of Dalbhum and Singhbhum. Meteorites.

VOL. IV, 1871.

Part 1 (*out of print*).—Annual report for 1870. Alleged discovery of coal near Gooty, and of indications of coal in Cuddapah district. Mineral statistics of Kumaon division.

Part 2 (*out of print*).—Axial group in Western Prome. Geological structure of Southern Konkan. Supposed occurrence of native antimony in the Straits Settlements. Deposit in boilers of steam-engines at Raniganj. Plant-bearing sandstones of Godavari valley, on southern extensions of Kamthi group to neighbourhood of Ellore and Rajmandri, and on possible occurrence of coal in same direction.

Part 3 (*out of print*).—Borings for coal in Godavari valley near Dumaguden and Bhadrachalam. Narbada coal-basin. Geology of Central Provinces. Plant bearing sandstones of Godavari valley.

Part 4 (*out of print*).—Ammonite fauna of Kutch. Raigur and Hengir (Gangpur) Coal-field. Sandstones in neighbourhood of first barrier on Godavari, and in country between Godavari and Ellore.

VOL. V, 1872.

Part 1 (*out of print*).—Annual report for 1871. Relations of rocks near Murree (Mari), Punjab. Mineralogical notes on gneiss of South Mirzapur and adjoining country. Sandstones in neighbourhood of first barrier on Godavari, and in country between Godavari and Ellore.

Part 2 (*out of print*).—Coasts of Beluchistan and Persia from Karachi to head of Persian Gulf, and some of Gulf Islands. Parts of Kummummet and Hanamconda districts in Nizam's Dominions Geology of Orissa. New coal-field in south-eastern Hyderabad (Deccan) territory.

Part 3 (out of print).—Muskat and Massandim on east of Arabia. Example of local jointing. Axial group of Western Prome. Geology of Bombay Presidency.

Part 4 (out of print).—Coal in northern region of Satpura basin. Evidence afforded by raised oyster banks on coasts of India, in estimating amount of elevation indicated thereby. Possible field of coal-measures in Godavari district, Madras Presidency. Lameta or intra-trappean formation of Central India. Petroleum localities in Pegu. Supposed eozoonal limestone of Yellam Bile.

Vol. VI, 1873.

Part 1.—Annual report for 1872. Geology of North-West Provinces.

Part 2 (out of print).—Bisrampur coal-field. Mineralogical notes on gneiss of south Mirzapur and adjoining country.

Part 3 (out of print).—Celt in ossiferous deposits of Narbada valley (Pliocene of Falconer): on age of deposits and on associated shells. Barakars (coal-measures) in Beddadanole field, Godavari district. Geology of parts of Upper Punjab. Coal in India. Salt-springs of Pegu

Part 4 (out of print).—Iron deposits of Chanda (Central Provinces). Barren Islands and Narkondam. Metalliferous resources of British Burma.

Vol. VII, 1874.

Part 1 (out of print).—Annual report for 1873. Hill ranges between Indus valley in Ladak and Shah-i-Dula on frontier of Yarkand territory. Iron ores of Kumaon. Raw materials for iron smelting in Raniganj field. Elastic sandstone, or so-called Itacolumyte. Geological notes on part of Northern Hazaribagh.

Part 2 (out of print).—Geological notes on route traversed by Yarkand Embassy from Shah-i-Dula to Yarkand and Kashgar. Jade in Karakas valley, Turkistan. Notes from Eastern Himalaya. Petroleum in Assam. Coal in Garo Hills. Copper in Narbada valley. Potash salt from East India. Geology of neighbourhood of Mari hill station in Punjab

Part 3 (out of print).—Geological observations made on a visit to Chaderkul, Thian Shan range. Former extension of glaciers within Kangra district. Building and ornamental stones of India. Materials for iron manufacture in Raniganj coal-field. Manganese ore in Wardha coal-field.

Part 4 (out of print).—Auriferous rocks of Dhambal hills, Dharwar district. Antiquity of human race in India. Coal recently discovered in the country of Luni Pathans, south-east corner of Afghanistan. Progress of geological investigation in Godavari district, Madras Presidency. Subsidiary materials for artificial fuel.

Vol. VIII, 1875

Part 1 (out of print).—Annual report for 1874. The Altum Artush considered from geological point of view. Evidences of 'ground-ice' in tropical India, during Talchir period. Trials of Raniganj fire-bricks.

Part 2 (out of print).—Gold-fields of south-east Wynaad, Madras Presidency. Geological notes on Khareean hills in Upper Punjab. Water-bearing strata of Surat district. Geology of Scindia's territories.

Part 3 (out of print).—Shahpur coal-field, with notice of coal explorations in Narbada regions. Coal recently found near Mofiong, Khasia Hills.

Part 4 (out of print).—Geology of Nepal. Raigarh and Hingir coal-fields.

Vol. IX, 1876.

Part 1 (out of print).—Annual report for 1875. Geology of Sind.

Part 2 (out of print).—Retirement of Dr. Oldham. Age of some fossil floras of India. Cranium of Stegodon Ganesa, with notes on sub-genus and allied forms. Sub-Himalayan series in Jamu (Jammoo) Hills.

Part 3 (out of print).—Fossil floras in India. Geological age of certain groups comprised in Gondwana series of India, and on evidence they afford of distinct zoological and botanical terrestrial regions in ancient epochs. Relations of fossiliferous strata at Maleri and Kota, near Sironcha, C. P. Fossil mammalian fauna of India and Burma.

Part 4 (out of print).—Fossil floras in India. Osteology of Merycopotamus dissimilis. Addenda and Corrigenda to paper on tertiary mammalia. Plesiosaurus in India. Geology of Pir Panjal and neighbouring districts.

Vol. X, 1877.

Part 1 (out of print).—Annual report for 1876. Geological notes on Great Indian Desert between Sind and Rajputana. Cretaceous genus Omphalia near Nameho lake, Tibet, about 65 miles north of Lhasa. Estheria in Gondwana formation. Vertebrata from Indian tertiary and secondary rocks. New Emydine from the upper tertiaries of Northern Punjab. Observations on under-ground temperature.

Part 2 (out of print).—Rocks of the Lower Godavari. 'Atgarh Sandstones' near Cuttack. Fossil floras in India. New or rare mammals from the Siwaliks. Aravali series in North-Eastern Rajputana. Borings for coal in India. Geology of India.

Part 3 (out of print).—Tertiary zone and underlying rocks in North-West Punjab. Fossil floras in India. Erratics in Potwar. Coal explorations in Darjiling district. Limestones in neighbourhood of Barakar. Forms of blowing machine used by smiths of Upper Assam Analyses of Ranigunj coals.

Part 4 (out of print).—Geology of Mahanadi basin and its vicinity. Diamonds, gold, and lead ores of Sambalpur district. 'Eryon Comp. Barrovensis,' McCoy, from Sripermatur group near Madras. Fossil floras in India. The Blaini group and 'Central Gneiss' in Simla Himalayas. Tertiaries of North-West Punjab. Genera Chœromeryx and Rhagatherium.

VOL. XI, 1878.

Part 1.—Annual report for 1877. Geology of Upper Godavari basin, between river Wardha and Godavari, near Sironcha. Geology of Kashmir, Kishtwar, and Pangi. Siwalik mammals. Palæontological relations of Gondwana system. 'Erratics in Punjab.'

Part 2 (out of print).—Geology of Sind (second notice). Origin of Kumaun lakes. Trip over Milam Pass, Kumaun. Mud volcanoes of Ramri and Cheduba. Mineral resources of Ramri, Cheduba and adjacent islands.

Part 3.—Gold industry in Wynaad. Upper Gondwana series in Trichinopoly and Nellore-Kistna districts. Senarmontite from Sarawak.

Part 4.—Geographical distribution of fossil organisms in India. Submerged forest in Bombay Island.

VOL. XII, 1879.

Part 1.—Annual report for 1878. Geology of Kashmir (third notice). Siwalik mammalia. Siwalik birds. Tour through Hangrang and Spiti. Mud eruption in Ramri Island (Arakan). Braunite, with Rhodonite, from Nagpur, Central Provinces. Palæontological notes from Satpura coal-basin. Coal importations into India.

Part 2.—Mohpani coal-field. Pyrolusite with Psilomelane at Gosalpur, Jabalpur district. Geological reconnaissance from Indus at Kurhalgarh to Kurram at Thal on Afghan frontier. Geology of Upper Punjab.

Part 3.—Geological features of northern Madura, Padukota State, and southern parts of Tanjore and Trichinopoly districts included within limits of sheet 90 of Indian Atlas. Cretaceous fossils from Trichinopoly district, collected in 1877-78. Sphenophyllum and other Equisetaceæ with reference to Indian form Trizygia Speciosa, Royle (Sphenophyllum Trizygia, Ung.). Mysoria and Atacamite from Nellore district. Corundum from Khasi Hills. Joga neighbourhood and old mines on Nerbudda.

Part 4.—'Attock Slates' and their probable geological position. Marginal bone of undescribed tortoise, from Upper Siwaliks, near Nila, in Potwar, Punjab. Geology of North Arcot district. Road section from Murree to Abbottabad.

VOL. XIII, 1880

Part 1.—Annual report for 1879 Geology of Upper Godavari basin in neighbourhood of Sironcha Geology of Ladak and neighbouring districts. Teeth of fossil fishes from Ramri Island and Punjab. Fossil genera Noggerathia, Stbg., Noggerathiopsis Fstm., and Rhiptozamites, Schmalh., in palæozoic and secondary rocks of Europe, Asia and Australia. Fossil plants from Kattywar, Shekh Budin, and Sirgujah. Volcanic foci of eruption in Konkan.

Part 2.—Geological notes. Palæontological notes on lower trias of Himalayas. Artesian wells at Pondicherry, and possibility of finding sources of water-supply at Madras.

Part 3. Kumaun lakes. Celt of palæolithic type in Punjab. Palæontological notes from Karharbari and South Rewa coal-fields. Correlation of Gondwana flora with other floras. Artesian wells at Pondicherry. Salt in Rajputana. Gas and mud eruptions on Arakan coast on 12th March 1879 and in June 1843.

Part 4 (out of print).—Pleistocene deposits of Northern Punjab, and evidence they afford of extreme climate during portion of that period. Useful minerals of Arvali region. Correlation of Gondwana flora with that of Australian coal-bearing system. Reh or alkali soils and saline well waters. Reh soils of Upper India. Naini Tal landslip, 18th September 1880.

VOL. XIV, 1881

Part 1. Annual report for 1880. Geology of part of Dardistan, Baltistan, and neighbouring districts. Siwalik carnivora. Siwalik group of Sub-Himalayan region. South Rewah Gondwana basin. Ferruginous beds associated with basaltic rocks of north eastern Ulster, in relation to Indian laterite. Rajmahal plants. Travelled blocks of the Punjab. Appendix to 'Palæontological notes on lower trias of Himalayas.' Mammalian fossils from Perim Island.

Part 2.—Nahan Siwalik unconformity in North-Western Himalaya. Gondwana vertebrates. Ossiferous beds of Hundes in Tibet. Mining records and mining record Office of Great Britain; and Coal and Metalliferous Mines Act of 1872 (England).

RECORDS

OF

THE GEOLOGICAL SURVEY OF INDIA.

Part 3.] 1926. [September.

THE MINERAL PRODUCTION OF INDIA DURING 1925.

BY E. H. PASCOE, M.A., SC.D. (Cantab), D.SC. (London), F.G.S., F.A.S.B., *Director, Geological Survey of India.*

CONTENTS.

I.—INTRODUCTION.

THE method of classification adopted in the first Review of Mineral Production published in these Records (Vol. XXXII), although admittedly not entirely satisfactory, is still the best that can be devised under present conditions. As the methods of collecting the returns become more precise and the machinery employed for the purpose more efficient, the number of minerals included in Class I- for which approximately trustworthy annual returns are available- increases, and it is hoped that the minerals of Class II—for which regularly recurring and full particulars cannot be procured—will in time be reduced to a very small number. In the case of minerals still exploited chiefly by primitive Indian methods, and thus forming the basis of an industry carried on by a large number of persons, each working independently and on a very small scale, the collection of reliable statistics is impossible, but the total error from year to year is not improbably approximately constant and the figures obtained may be accepted as a fairly reliable index to the general trend of the industry. In the case of gold, the small indigenous alluvial industry contributes such an insignificant portion to the total outturn that any error from this source may be regarded a negligible.

The average value of the Indian rupee during the year 1925 was 1*s.* $6\frac{1}{32}d.$: the highest value reached was 1*s.* $6\frac{5}{16}d.$, and the lowest 1*s.* $5\frac{1}{16}d.$ The values shown in table 1 and all following tables of the present Review are given on the basis of 1*s.* $5\frac{1}{4}d.$ to the rupee for 1924 and 1*s.* $6\frac{1}{32}d.$ to the rupee for 1925, the latter value being taken for ease of calculation as equivalent to Rs. 13·3 to £1, instead of Rs. 13·310.

From Table 1 it will be seen that there has been an apparent decrease of nearly £1,121,000 or about 3·9 per cent. in the value of the total production over that of 1924. This decrease is minimised by a slight increase in the average exchange value of the rupee. An increase or decrease in value does not always correspond to a similar variation in output, and cannot, therefore, be regarded as an infallible indication of the state of an industry.

The number of mineral concessions granted during the year amounted to 859 against 769 in the preceding year; of these one was an exploring license, 737 were prospecting licenses and 121 were mining leases.

TABLE 1.—*Total Value of Minerals for which returns of production are available for the years 1924 and 1925.*

	1924 (£1 Rs. 13·9).	1925 (£1 Rs. 13·3)	Increase.	Decrease.	Variation per cent.
Coal	(*a*)10,766,433	9,503,828	..	1,262,605	—11·7
Petroleum	7,559,233	7,740,727	181,494	..	+ 2 4
Manganese (*b*)	2,719,949	2,617,220	..	102,729	3 8
Gold	1,827,133	1,673,501	..	153,932	— 8 4
Lead and lead-ore	1,694,679	1,666,726	..	27,953	—1·6
Building materials	733,117	853,851	120,734	..	+ 16·5
Mica (*c*)	679,796	799,183	119,687	..	+ 17 6
Silver	810,869	705,503	..	105,366	12·9
Salt	700,717	574,628	..	126,089	18 0
Iron-ore	279,610	336,775	57,165	..	+ 20 5
Tin and tin ore	(*a*) 208,179	267,931	59,752	..	+ 28·7
Copper-matte	114,714	262,297	147,583	..	+ 128·6
Zinc ore (*c*)	83,486	156,375	72,889	..	+ 87 3
Saltpetre (*c*)	201,382	147,617	..	53,765	26 7
Chromite	42,259	40,171	..	2,088	—4 9
Tungsten ore	24,559	33,975	9,416	..	+ 38 2
Magnesite	21,088	31,179	10,091	..	47 8
Ruby, Sapphire and Spinel.	34,773	27,454	..	7,319	21 0
Clays	25,178	21,795	..	3,383	- 13·4
Jadeite (*c*)	50,849	12,237	..	38,612	- 75 9
Steatite	4,977	9,750	4,773	..	95 9
Bauxite	13,531	6,320	..	7,211	53·3
Monazite	9,501	..	..	9,301	100 0
Gypsum	5,527	5,810	283	..	+ 5·0
Zircon	2,717	1,608	1,891	..	+ 69·6
Kyanite	242	3,022	2,780	..	..
Ochre	4,800	2,784	..	2,016	—42 0
Alum	1,359	1,718	359	..	+ 26 4
Fuller's earth	1,153	1,615	462	..	+40·0
Barytes	2,255	1,328	..	927	—41·1
Diamonds	1,985	1,098	..	887	- 14·7
Apatite	1,892	850	..	4,042	- 82·6
Amber	1,101	710	..	391	- 35 5
Ilmenite	1,381	492	..	889	- 64·3
Asbestos	1,354	361	..	993	—73 3
Soda	96	171	75	..	—78·1
Antimony	..	26	26	..	..
Oil shale	..	15	15	..	..
Serpentine	5	8	3	..	—60·0
Copperas	..	1	1	..	.
Bismuth ore	17	..	..	17	..
Total	**28,634,996**	**27,513,960**	789,179	1,910,515	**— 3·9**
			1,121,036		

(*a*) Revised. (*b*) Value f.o.b. (*c*) Export values.

II.—MINERALS OF GROUP I.

Chromite.	Iron.	Manganese.	Ruby, Sapphire	Silver.
Coal.	Jadeite.	Mica.	and Spinel.	Tin.
Copper.	Lead.	Monazite.	Salt.	Tungsten.
Diamonds.	Magnesite.	Petroleum.	Saltpetre.	Zinc.
Gold.				

Chromite.

There was again a decrease in the production of chromite in India during 1925, amounting to 8,010 tons. For the greater part of this decrease the Zhob valley deposits were responsible. The total exports from India during the year amounted to 48,323 tons and exceeded the production; the latter was evidently supplemented from stocks accumulated in 1924. Chromite exported from the ports in British India amounted to 36,157 tons against 30,089 tons in 1924. Chromite mined in British India is also exported from the port of Mormugao in Portuguese India; the quantity exported during 1924 and 1925 was 1,699 tons and 12,166 tons respectively.

TABLE 2.—*Quantity and value of Chromite produced in India during 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value. (£1 = Rs. 13·9)		Quantity.	Value. (£ 1 = Rs. 13·3)	
Baluchistan—	Tons.	Rs.	£	Tons.	Rs.	£
Quetta-Pishin .	81	403	29	10	150	11
Zhob . .	26,629	3,81,810	27,468	18,188	2,65,121	19,934
Bihar and Orissa—						
Singhbhum .	1,140	19,241	1,384	3,038	69,274	5,208
Mysore State —						
Hassan . .	13,791	1,09,528	7,880	8,662	82,896	6,233
Kadur . .	..	.	.	1,900	15,200	1,143
Mysore . .	3,821	76,420	5,498	5,654	1,01,639	7,642
Total .	**45,462**	*5,87,102*	*12,259*	**37,452**	*5,34,280*	*40,171*

Coal.

There was a decrease during the year of about 270,000 tons, or about 1·3 per cent., in the output of coal. This decrease was due chiefly to Bihar and Orissa and Bengal, partly to Central India and Assam, and to a small extent to Baluchistan and the Punjab. The production in the Central Provinces and Hyderabad shewed a substantial improvement, and that of Rajputana increased over 6,000 tons. The decrease in Bengal was from the Raniganj field,

and in Bihar and Orissa mostly from the Jharia field; there was a substantial rise in the output from Bokaro which now produces over 7 per cent. of the Indian total. Giridih also increased her raisings by some 18,000 tons, while Jainti and Rampur continued to decline. An initial production from Karanpura of 13,354 tons is worthy of note. In Central India, Sohagpur failed to continue its rapid upward tendency and shewed a decline of some 15,000 tons. In the Central Provinces there were substantial increases in the cases of Ballarpur and Pench Valley, and a reduction in the case of Mohpani. For the increase in Hyderabad, Singareni was mainly responsible, but the Sasti field contributed an additional 13,000 tons. Amongst the Tertiary fields of Assam, Makum and, to a less extent, the Naga Hills were responsible for a deficit. In Baluchistan the Khost field continued to decline. The output from the Jhelum district of the Punjab declined, while the Bikanir field of Rajputana shewed improvement.

The total value of the coal produced in India decreased from Rs. 14,96,53,419 (£10,766,433) in 1924 to Rs. 12,64,00,908 (£9,503,828) in 1925.

There was a reduction in the pit's mouth value per ton of coal in all provinces except the Central Provinces (the figure for Burma is not available); this fall in value was severe in all cases except in Assam and Rajputana, where it amounted only to Rs. 0-2-10 and Rs. 0-2-2 respectively. In the two great coal provinces, Bihar and Orissa and Bengal, the price dropped Rs. 1-0-6 and Rs. 1-4-5 respectively. In Central India it fell Rs. 1-3-8; in the Punjab the fall was Rs. 0-8-0. The maximum fall, Rs. 2-13-5, was in Baluchistan, where, however, conditions are abnormal and coal supplies small.

TABLE 3.—*Average price (per ton) of Coal extracted from the Mines in each Province during the years 1924 and 1925.*

	1924.	1925.
	Rs. A. P.	Rs. A. P.
Assam	8 12 11	8 10 1
Baluchistan	15 14 2	13 0 9
Bengal	8 0 11	6 12 6
Bihar and Orissa	6 11 9	5 11 3
Burma	30 0 0	(*a*)
Central India	5 12 11	4 9 3
Central Provinces	6 1 5	6 3 2
Punjab	8 11 5	8 3 5
Rajputana	7 1 4	6 15 2

(*a*) Not available.

TABLE 4.—*Origin of Indian Coal raised during 1924 and 1925.*

——	Average of last five years.	1924.	1925.
	Tons.	Tons.	Tons.
Gondwana Coalfields . . .	18,960,913	(*a*) 20,696,338	20,447,898
Tertiary Coalfields	160,550	477,946	456,479
Total .	19,421,463	21,174,284	20,904,377

(*a*) Revised

TABLE 5. *Provincial Production of Coal during the years 1924 and 1925.*

Province.	1924.	1925.	Increase.	Decrease.
	Tons.	Tons.	Tons	Tons.
Assam	334,842	318,842	..	16,000
Baluchistan	40,557	34,797	..	5,760
Bengal.	5,031,655	4,913,852	..	117,803
Bihar and Orissa . . .	(*a*)14,105,529	13,938,509	..	167,020
Burma.	255	25	..	230
Central India . . .	235,298	219,106	.	16,192
Central Provinces . . .	679,081	708,554	29,473	..
Hyderabad	644,775	667,877	23,102	..
Punjab	80,122	74,662	..	5,760
Rajputana	21,870	28,153	6,283	..
Total .	**21,174,284**	**20,904,377**	58,858	328,765

(*a*) Revised.

TABLE 6.—*Output of Gondwana Coalfields for the years 1924 and 1925.*

Coalfields.	1924.		1925.	
	Tons.	Per cent. of Indian Total.	Tons.	Per cent. of Indian Total.
Bengal, Bihar and Orissa—				
Bokaro	1,343,500	6·34	1,494,966	7·15
Daltonganj	4,691	0·02	17,274	·08
Giridih	768.690	3·63	786,642	3·76
Jainti	78,547	0·38	76,680	·37
Jharia	10,845,642	51·22	10,676,883	51·08
Karanpura	..	..	13,354	·07
Rajmahal Hills	..	..	1,653	·01
Ramgarh	5,905	0·03	2,548	·01
Rampur (Raigarh Hingir)	49,115	0·23	45,410	·22
Raniganj	6,035,347	28·51	5,729,686	27·42
Talchir	5,417	0·03	7,265	·04
Central India—				
Sohagpur	131,174	0·62	116,170	·55
Umaria	104,124	0·49	102,936	·49
Central Provinces—				
Ballarpur	127,545	0·60	150,490	·72
Hoshangabad	3	..	..	..
Mohpani	76,526	0·36	70,059	·34
Pench Valley	473.896	2·24	485,768	2·30
Shahpur	1,111	..	1,119	·01
Yeotmal	..	..	1,138	·01
Hyderabad—				
Sasti	25,050	0·12	38,153	·18
Singareni	619,725	2·93	629,724	3·01
Total	(a)20,696,338	97 75	20,447,898	97·82

(a) Revised.

TABLE 7.—*Output of Tertiary Coalfields for the years 1924 and 1925.*

	1924.		1925.	
	Tons.	Per cent. of Indian Total.	Tons.	Per cent. of Indian Total.
Assam—				
Khasi and Jaintia Hills	280	1·58	845	1·52
Makum	274,479		262,959	
Naga Hills	60,083		55,038	
Baluchistan—				
Khost	25,678	0·19	17,085	0·17
Sor Range, Kalat, Mach	14,879		17,712	
Burma—				
Kamapying (Mergui)	255	0·00	..	..
Southern Shan States	..	..	(*a*) 25	0·00
Punjab—				
Jhelum	52,942	0·38	49,369	0·36
Mianwali	18,787		18,341	
Shahpur	8,693		6,952	
Rajputana—				
Bikanir	21,870	0·10	28,153	0·13
Total	477,946	2·25	456,479	2·18

(*a*) Despatched to England for analysis.

The export statistics for coal during 1925 again shew an increase amounting to some 10,000 tons, the total exports of coal and coke rising from 206,483 to 216,370 tons, 838 tons of the latter being coke (see Table 8). The imports also rose from 463,716 to 483,160 tons, the increase of about 19,400 tons being restricted to coal (see Table 9). As before the exports were mainly to Ceylon. The bulk of the imports still come from S. Africa though this figure is very much less than it was in the years 1921, 1922 and 1923; it, however, was some 11,100 tons greater than the figure for the previous year 1924. The imports from Portuguese East Africa fell to almost precisely the same extent as those from the Union of S. Africa rose. As in 1924 Portuguese East Africa still ranks second in the list of countries supplying India with coal, while the United Kingdom still comes third: imports from the latter rose to the extent of about 22,100 tons more than the figure for 1924.

TABLE 8.—*Exports of Indian Coal and Coke during the years 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13·9).		Quantity.	Value (£1 = Rs. 13·30.	
To—	Tons.	Rs	£	Tons.	Rs.	£
Ceylon	178,419	29,01,638	208,751	194,189	28,65,560	215,456
Straits Settlements (including Labuan).	17,638	2,99,345	21,536	19,034	3,27,218	24,603
Other Countries	9,461	1,89,046	13,600	2,309	38,384	2,886
TOTAL	205,518	33,90,029	243,887	215,532	32,31,162	242,945
Coke	965	29,069	2,091	838	21,329	1,603
Total of Coal and Coke	**206,483**	*34,19,098*	*245,978*	**216,370**	*32,52,491*	*244,548*

TABLE 9.—*Imports of Coal and Coke during the years 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13·9).		Quantity.	Value (£1 = Rs. 13·3).	
From—	Tons.	Rs.	£	Tons.	Rs.	£
Australia and New Zealand.	21,803	7,40,279	53,257	7,495	2,34,485	17,630
Portuguese East Africa	141,537	35,74,357	257,148	130,312	29,36,146	220,763
Union of South Africa	172,473	41,79,946	300,716	183,582	42,22,505	317,482
United Kingdom	89,785	31,11,064	223,817	111,898	29,65,309	222,956
Other Countries	5,319	1,40,981	10,143	17,053	3,97,402	29,879
TOTAL	430,917	1,17,46,627	845,081	450,340	1,07,55,847	808,710
Coke	32,799	13,16,028	94,721	32,820	10,41,218	78,287
Total of Coal and Coke	**463,716**	*1,30,63,255*	*939,802*	**483,160**	*1,17,97,065*	*886,997*

The average number of persons employed in the coalfields during the year shewed an appreciable decrease in excess of that required to account for the reduced production. The average output per person employed, therefore, showed an advance on the previous year, the figure of 103·7 tons for 1924 rising to 110·5 tons for 1925; this is not far short of the figure for 1919 which was 111·05 tons. There was again a gratifying reduction in the number of deaths by accident; these amounted to 202, a considerable improvement on the annual average for the quinquennium 1919-23 which was 274, and not due to smaller production. There was also a reduction in the death-rate which again fell from 1·34 per thousand persons employed in 1924 to 1·07 for 1925; the figure for 1923 was 1·81.

TABLE 10.—*Average number of Persons Employed daily in the Indian Coalfields during the years 1924 and 1925.*

	Number of persons employed daily.		Output per person employed in tons.	Number of deaths by accident.	Death-rate per 1,000 persons employed.
	1924.	1925.			
Assam	4,464	4,199	75·9	8	1·9
Baluchistan	1,108	951	36·6	1	1·1
Bengal	43,621	42,781	114·9	40	0·9
Bihar and Orissa	(*a*)128,523	114,934	121·3	126	1·1
Burma	23	19	1·3	..	..
Central India	3,157	2,759	79·4	1	0·4
Central Provinces	8,125	9,174	77·2	9	0·9
Hyderabad	13,590	12,701	52·6	15	1·2
Punjab	1,575	1,579	47·3	2	1·3
Rajputana	120	165	170·6	..	..
Total	**204,306**	**189,262**	..	202	..
AVERAGE	..	..	110·5	..	1·07

(*a*) Revised.

Copper.

The suspension of the operations of the Cape Copper Co. in 1923, recorded previously, continued during 1925. In the Review for 1923, references were made to the results of the prospecting operations of the Cordoba Copper Co. on the Singhbhum Copper Belt. In 1924 this company was reconstructed as the Indian Copper Corporation, Ltd., with a capital of £225,000. This new company acquired not only the properties of the Cordoba Copper Co., but also those of the North Anantapur Gold Mines, Ltd., lying immediately to the north, and the property in Kharsawan prospected by the Ooregum Gold Mining Company of India, Ltd.

All work is at present being concentrated upon the Mosaboni area where a vertical depth of 385 feet has been reached and where 471,500 tons of ore of the average contents of 18,328·73 tons of copper had been developed by the end of December 1925. The erection of concentrating and smelting plant is shortly being started, and the production stage should soon be reached.

In Burma the production of 2,935 tons of copper-matte valued at Rs. 15,94,527 (£114,714) was reported by the Burma Corporation,

Ltd., in the Northern Shan States in 1924. The production rose to 8,029 tons valued at Rs. 34,88,552 (£262,297) during the year under review.

Diamonds.

There was a further decrease in the output of diamonds from Central India, which amounted to 47·63 carats, valued at Rs. 14,598 (£1,098), against 66·6 carats, valued at Rs. 27,596 (£1,985) in the preceding year.

Gold.

The recovery made by the gold mines in the Anantapur district of Madras in 1924 was unfortunately a temporary one only, for both the North Anantapur Gold Mines, Ltd. and the Jubital Gold Mines Ltd., have now suspended mining operations. The small output shown against Madras represents the amount recovered by cyanide treatment of mill tailings which have now been exhausted.

In spite of an increase of 935 oz. from the Kolar mines of Mysore, therefore, there was a total decrease in the Indian output amounting to 2,476 oz. In the Ooregum mine of the Kolar field which in August of this year had reached a depth of 6,379 feet, rock-bursts continue to give trouble, but recent development work has proved the rich nature of the lower levels of the mine down to the deepest point yet explored. An increase in the ore reserves of the Champion Reef mine has also been established; this mine, which has now reached a depth of 6,472 feet, also suffers from rock-bursts.

TABLE 11.—*Quantity and value of Gold produced in India during the years 1924 and 1925.*

	1924			1925.			
	Quantity	Value (£1=Rs. 13 9)		Quantity	Value (£1=Rs. 13 3).		Labour.
	Oz.	Rs	£	Oz	Rs	£	
Burma—							
Katha	2,578	1,441	104	197	1,265	95	30
Upper Chindwin	4322	3,194	230	134	1,286	97	99
Madras							
Anantapur	(*a*) 1,646·00	2,38,605	17,166	(*a*) 285·0	16,517	1,242	193
Mysore	(*a*) 92,578·18	2,51,51,948	1,809,708	(*a*) 104,512·8	2,22,80,295	1,671,901	19,347
Punjab	57·87	2,975	214	37·4	1,974	149	53
United Provinces	22·5	150	11	3·8	225	17	14
Total	**396 351·10**	**2,54,01,319**	**1,827,133**	**393,875·1**	**2,24,07,962**	**1,673,501**	**19,736**

(*a*) Fine gold.

Iron.

As previously shewn the production of iron ore in India shewed an increase of 28·6 per cent. in 1923, and an increase of 76 per cent. in 1924; in 1925 there was an increase over the previous year of 6·8 per cent., amounting to 99,265 tons. The figure shewn against the Mayurbhanj State in Table 12 represents the production by the Tata Iron and Steel Company, Ltd., whilst of that recorded against Singbhum 227,722 tons were produced by the Indian Iron and Steel Company from their mines at Gua and the balance of 249,858 tons by the Bengal Iron Company.

TABLE 12.—*Quantity and value of Iron-ore produced in India during the years 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13 9).		Quantity.	Value (£1 = Rs. 13 3).	
	Tons.	Rs.	£	Tons.	Rs.	
Bihar and Orissa—						
Mayurbhanj	996,920	24,92,300	179,302	957,275	28,71,825	215,927
Sambalpur	654	4,578	330	703	4,920	370
Singhbhum	305,238	7,39,619	53,210	477,580	12,36,840	92,996
Burma—						
Mandalay	328	(*a*)1,312	94	1,013	(*a*)4,052	305
Northern Shan States	58,686	(*a*)2,34,744	16,888	50,604	(*a*)2,02,416	15,219
Central Provinces	68,361	3,73,702	26,885	1,037	4,182	314
Mysore	14,958	39,324	2,829	6,218	1,54,010	11,579
Other Provinces and States	168	1,001	72	148	866	65
Total	**1,445,313**	*38,86,580*	*279,610*	**1,544,578**	*44,79,101*	*336,775*

(*a*) Estimated.

Although the quantity of ore raised by Messrs. The Tata Iron and Steel Co. was 39,645 tons less in 1925 than it was in the previous year, the output of refined products at the Jamshedpur works shewed substantial increases in the case of pig iron and steel (including steel rails); the former rose from 540,140 tons in 1924 to 563,160 tons in 1925 and the latter from 218,472 tons in 1924 to 309,938 tons in 1925. Between the same periods there was a decrease in their production of ferro-manganese from 8,951 tons to 6,527 tons. The production of the Bengal Iron Co., Ltd., fell from 147,733 tons of pig-iron in 1924 to 52,674 tons in 1925, and from 27,045 tons of iron castings in 1924 to 5,911 tons in 1925; these deficiencies were in part compen-

sated by an output of sleepers and pipes during the year under review amounting to 29,327 tons. The Indian Iron and Steel Co., Ltd., again increased their production of pig-iron from 168,249 tons in 1924 to 247,500 tons in 1925. Neither the Bengal Iron Company nor the Indian Iron and Steel Company produced any ferro-manganese.

The Mysore Iron Works commenced producing pig-iron in 1923 when the quantity manufactured amounted to 9,732 tons; in the next year the figure rose to 16,425 tons and during 1925 was 16,741 tons.

In 1925 211 indigenous furnaces were at work in the Central Provinces and Berar for the purpose of smelting iron ore, as compared with 229 in 1924; 103 of these were operating in the Bilaspur district, 68 in Raipur, 35 in Mandla, 4 in Saugor and 1 in Jubbulpore.

The output of iron ore in Burma is by the Burma Corporation, Limited, and is used as a flux in lead-smelting.

The total production of pig-iron in India again rose, therefore, from 872,547 tons in 1924 to 880,075 tons in 1925. Some of it was employed at Jamshedpur in the manufacture of steel, but a large proportion, as in past years, was exported. Table 13 will shew that exports increased to the extent of 40,663 tons, the United States, Germany and China being mainly responsible. It is interesting to note that the export value, which had fallen from Rs. 69·8 (£4·65) per ton in 1923-24 to Rs. 68·5 (£4 57) per ton in 1924-25, shewed a still greater fall in 1925-26 to Rs. 45·7 (£3·44) per ton.

TABLE 13.—*Exports of Pig-iron from India during 1924-25 and 1925-26.*

	1924-25.			1925-26.		
	Quantity.	Value (£1 = Rs. 13 9).		Quantity.	Value (£1 = Rs. 13·3).	
	Tons.	Rs.	£	Tons.	Rs.	£
To—						
United Kingdom	19,024	13,20,823	95,023	20,178	9,33,916	70,219
Germany	1,620	67,751	4,874	11,288	5,24,509	39,437
Italy	4,552	3,13,708	22,569	4,225	1,97,487	14,849
China including Hong-kong.	2,905	1,76,849	12,723	11,214	5,11,084	38,472
Japan	171,065	1,15,01,074	827,415	168,188	76,57,025	575,716
United States of America	133,761	77,71,463	559,098	156,064	72,18,036	542,709
Australia	201	13,052	940	401	18,519	1,393
New Zealand	3,987	2,69,269	19,372	3,271	1,53,984	11,578
Other Countries	3,611	2,47,705	17,820	7,160	3,35,044	25,191
Total	**341,326**	*2,16,81,694*	*1,559,834*	**381,989**	*1,75,50,204*	*1,319,564*

The Steel Industry (Protection) Act was passed in 1924 and authorised, to companies employing Indians, bounties, which were granted upon rails and fishplates wholly manufactured in British India from material wholly or mainly produced from Indian iron ore and complying with specifications approved by the Railway Board, and upon iron or steel railway wagons a substantial portion of the component parts of which had been manufactured in British India. This Act will expire on the 31st March 1927, but the question of the extension of protection is under the consideration of the Tariff Board.

Jadeite.

The fall in the output of Jadeite which commenced after the year 1922 has persisted, and the output, which in 1924 amounted to 2,630·4 cwts. valued at Rs. 8,60,493 (£61,906), decreased to 1,696·5 cwts. valued at Rs. 2,67,148 (£20,086) in 1925. The marked fall in the price was due to the outbreak of civil war in China which is the only important market for jadestone exported from Burma. The output figures are always incomplete and a more correct idea of the extent of the Burmese Jadeite industry is usually obtainable from the export figures. Exports by sea fell from 2,766 cwts. valued at Rs. 7,06,800 (£50,849) in 1924-25 to 972 cwts. valued at Rs. 1,62,751 (£12,237) in 1925-26. Exports from Burma by land in 1924-25 amounted to 212 cwts; those for 1925-26 are not known as the registration of the Land Frontier Trade of Burma has been discontinued.

Lead.

Although there was a further increase of 33,600 tons in the production of lead-ore at the Bawdwin mines of Burma the total amount of metal extracted decreased from 50,559 tons of lead and 1,200 tons of antimonial lead, valued at Rs. 2,35,07,040 (£1,691,154) in 1924 to 46,175 tons of lead and 1,100 tons of antimonial lead, valued at Rs. 2,21,07,128 (£1,662,190) in 1925. The quantity of silver extracted from Bawdwin ores also decreased from 5,287,711 oz. valued at Rs. 1,12,26,868 (£807,688) to 4,831,548 oz. valued at Rs. 93,36,580 (£701,998). The value, however, of the lead extracted increased slightly from Rs. 459 (£33·0) per ton in 1924 to Rs. 462 (£34·7) per ton in the year under review and that of silver decreased from Rs. 2-1-11½ (36 6*d.*) to Rs. 1-14-11 (34 9*d.*) per oz.

TABLE 14.—*Production of Lead and Silver ore during 1924 and 1925.*

	1924.					1925.				
	Quantity.	Value (£1=Rs. 13·3)				Quantity.	Value (£1=Rs. 13·3).			
	Lead-ore.	Lead-ore and Lead		Silver.		Lead-ore.	Lead-ore and Lead.		Silver.	
	Tons.	Rs.	£	Rs.	£	Tons.	Rs.	£	Rs.	£
Burma—										
Northern Shan States	287,777	(a) 2,35,07,040	1,691,154	(b) 1,12,26,585	807,688	321,389	(c) 2,21,07,128	1,662,196	(d) 93,36,580	701,998
Southern Shan States	2,509	49,000	3,525	..	..	445	59,525	4,47	..	..
Yamethin	..	..	..	..	..	20	800	60	..	..
Total	**310,286**	*2,35,56,040*	*1 694.679*	*1,12,26,585*	*807.688*	**321,854**	*2.21.67.453*	*1,666,726*	*93.36,580*	*701,998*

(*a*) Value of 50.559 tons of lead (Rs 2,32,00,868) and 1,200 tons of antimonial lead (Rs. 3,06,172) extracted.
(*b*) Value of 5,287,711 oz. of silver extracted.
(*c*) Value of 46,175 tons of lead (Rs 2,18,24,219) and 1,100 tons of antimonial lead (Rs. 2,83,909) extracted.
(*d*) Value of 4,831,548 oz. of silver extracted.

Magnesite.

The magnesite industry in the Salem district of Madras, which revived in 1921, continues to flourish. During 1925 there was an increase in production of more than 5,000 tons over that of the preceding year; the total, 29,620 tons is the highest output yet recorded. The mines in Mysore were not worked in 1925.

TABLE 15.—*Quantity and value of Magnesite produced in India during 1924 and 1925.*

	1924			1925.		
	Quantity	Value (£1=Rs. 13·9).		Quantity	Value (£1=Rs. 13·3).	
	Tons	Rs.	£	Tons.	Rs.	£
Madras -						
Salem	24,427	2,93,124	21,088	29,620	4,14,680	31,179
Mysore	34	(*a*)	.	..	..	..
Total	**24,461**	***2,93,124***	***21,088***	**29,620**	***4,14,680***	***31,179***

(*a*) Not available.

Manganese.

A rise in the output of manganese ore in India is again to be recorded, the total for 1924, 803,006 tons valued at £2,719,949 f. o. b. Indian ports, rising to 839,461 tons valued at £2,617,220, f. o. b. Indian ports, during the year under consideration. The figure for output has only once been exceeded previously, *viz.*, in 1907 when 902,291 tons were raised. It will be noticed that concurrent with a rise in output there was a fall in value, the total value for 1925 being £102,729 less than that for 1924. This was apparently due to a fall in price. In 1924 first grade ore c. i. f. United Kingdom ports fetched an average price of 22·9*d.* per unit; in 1925 this price fell to 21·5*d.* A fall in price was anticipated in view of the agreement between an American group of financiers and the Soviet Government for the development on modern lines of the manganese ores of the Caucasus.

In the case of the output from Bihar and Orissa the decreases in Gangpur and Singhbhum were balanced by an increase in Keonjhar. In the Bombay Presidency the Panch Mahals shew a substantial increase and Chhota Udepur shews a small decrease; a production from Belgaum, amounting to 3,604 tons, is recorded for the first time since 1916. After a break of several years Jhabua State in Central India had resumed production in 1924, and shews

an increase of nearly 1,000 tons in the year under review. The most important Indian manganese areas, *viz.*, those of the Central Provinces, exhibit an increase of over 38,000 tons, the decrease in Balaghat being more than compensated by increases in the cases of Nagpur, Bhandara and Chhindwara. In Madras, Bellary maintained its level, while an increase in the Sandur State output more than balanced a deficit in Vizagapatam. Mysore shews a fall in output due principally to the Shimoga district.

TABLE 16.—*Quantity and value of Manganese-ore produced in India during 1924 and 1925.*

	1924.		1925.	
	Quantity.	Value f. o. b. at Indian ports.	Quantity.	Value f. o. b. at Indian ports.
	Tons.	£	Tons.	£
Bihar and Orissa—				
Gangpur	16,481	57,134	9,617	30,334
Keonjhar	20,803	54,434	26,330	66,264
Sambalpur	..	..	703	2,217
Singhbhum	797	2,764	195	615
Bombay —				
Chhota Udepur	10,142	34,631	6,805	21,166
Belgaum	..	..	3,604	11,368
Panch Mahals	46,401	160,857	52,069	164,234
Central India —				
Jhabua	2,263	6,299	3,206	8,576
Central Provinces—				
Balaghat	270,151	988,302	262,450	873,740
Bhandara	74,869	273,896	104,398	347,558
Chhindwara	32,715	119,682	37,109	123,542
Jubbulpore	1,850	6,768	1,901	6,329
Nagpur	204,521	748,206	216,484	720,711
Madras—				
Bellary	5,424	11,481	5,419	11,064
Kurnool	390	858	6	13
Sandur State	43,809	92,729	52,576	107,343
Vizagapatam	31,811	72,635	26,909	59,200
Mysore—				
Chitaldrug	1,556	3,423	2,494	5,289
Shimoga	36,206	79,653	24,572	52,113
Tumkur	2,817	6,197	2,614	5,544
Total	**803,006**	*2,719,949*	**839,461**	*2,617,220*

The exports of manganese ore, which during 1924 fell to the extent of about 100,000 tons, again decreased in 1925 by about 27,600 tons, as shewn in table 17. There is a steady consumption of manganese ore at the works of the three principal Indian iron and steel companies, not only for use in the steel furnaces of the Tata Iron & Steel Co., and the manufacture of ferro-manganese, but also for addition to the blast-furnace charge in the manufacture of pig-iron. The receipts of manganese ore at the iron and steel works during 1925 were 38,242 tons, nearly 11,000 tons more than the figure for 1924; the consumption in the industry was 34,843 tons, slightly less than it was in the previous year.

Table 18 shews the distribution of the manganese ore exported from British Indian ports (excluding the Portuguese port of Mormugao) during 1924 and 1925, from which it will be seen that the amount absorbed by the United States in 1925 dropped to a half of what it was in 1924. There was also a continued fall in the receipts of the United Kingdom. The marked increase in the quantity despatched to Germany is significant.

TABLE 17.—*Exports of Manganese-ore during 1924 and 1925, according to Ports of Shipment.*

Port.	1924.	1925.
	Tons.	Tons.
Bombay	279,024	311,825
Calcutta	342,067	264,170
Madras	36,600	28,203
Mormugao (Portuguese India)	108,758	134,653
Total	**766,449**	**738,851**

TABLE 18.—*Exports of Manganese-ore from British Indian Ports during the years 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1=Rs. 13·9).		Quantity.	Value (£1=Rs. 13·3).	
To	Tons.	Rs.	£	Tons.		£
United Kingdom	203,546	43,27,571	311,336	180,472	45,09,085	339,029
Germany	7,300	1,67,186	12,028	30,258	7,90,650	59,447
Belgium	189,197	50,85,837	365,888	175,334	47,56,421	357,626
France	148,150	33,92,825	244,088	150,585	36,93,370	277,697
Italy	8,242	3,32,688	23,934	16,875	8,36,808	62,918
United States of America.	98,094	31,78,095	228,640	49,104	13,85,750	104,192
Other Countries	3,162	1,15,162	8,285	1,510	60,187	4,525
Total	**657,691**	*1,65,99,364*	*1,194,199*	**604,198**	*1,60,32,271*	*1,205,434*

Mica.

There was again an increase, amounting to some 5,000 cwts., in the declared output of mica in 1925 above that of the previous year. As has been frequently pointed out, the output figures are incomplete, and a more accurate idea of the size of the industry is to be obtained from the export figures. In 1924 the export figures, in fact, exceeded the reported production by over 71 per cent., amounting to 70,095 cwts., valued at Rs. 94,49,168 (£679,796); in 1925 the quantity exported—99,699 cwts., valued at Rs. 1,06,33,123 (£799,483)—was more than double the reported production. The average price of the mica exported fell from Rs. 135 (£9·7) per cwt. in 1924 to Rs. 107 (£8·0) per cwt. in 1925, a price Rs. 10 more than that obtained in 1923.

TABLE 19.—*Quantity and value of Mica produced in India during 1924 and 1925.*

	1924.			1925.		
	Quantity	Value (£1 = Rs. 13·9).		Quantity.	Value (£1 = Rs. 13·3).	
	Cwts.	Rs.	£	Cwts.	Rs.	£
Bihar and Orissa—						
Bhagalpur	15	530	38	..	..	..
Gaya	5,274	2,56,496	18,453	3,631	1,80,811	13,595
Hazaribagh	23,205	11,74,060	84,464	25,606	12,67,390	95,292
Monghyr	242	18,514	1,332	673	37,675	2,833
Delhi	20	28	2	..	..	..
Gwalior	..	..	..	120	3,303	248
Madras—						
Nellore	10,90	1,97,307	35,778	14,378	5,91,390	44,466
Nilgiris	365	50,041	3,600	401	54,614	4,106
Mysore—						
Hassan	..	..	..	48·5	2,690	202
Mysore	15·2	(*a*)	(*a*)	114·7	7,390	556
Rajputana—						
Ajmer-Merwara	509	46,710	3,363	401·7	40,920	3,077
Shahpura	351·7	15,192	1,093	316·4	13,333	1,003
Total	40,907·9	20,58,017	148,123	45,990·3	21,99,516	165,377

(*a*) Not available.

Monazite.

The recovery in the monazite industry of Travancore reported in 1924, when the output rose to 622·3 tons, valued at £9,301·5, did not, unfortunately, continue. The reported production for 1925 was 1 cwt. only. During 1921 the figure reached 1,260 tons, valued at nearly £31,000.

Petroleum.

The world production of petroleum in 1925 exceeded that of any previous year, amounting to over 151¼ million tons; of this India

contributed about 0·8 per cent. As remarked before petroleum statistics prove that it is becoming more and more difficult to maintain the output of India (including Burma) at the high level it reached in 1919 and 1921, when peak productions of well over 305½ million gallons were reached. During the year under consideration the total production amounted to over 289½ million gallons against about 294½ million gallons in 1924. There is now little doubt that this deficit of some 5 million gallons, small as it is forms part of the evidence that the inevitable decline has set in, and, with possible interruptions, is likely to continue slowly and steadily during the present generation, unless a new field of importance is discovered. The chances of the latter recede year by year as exhaustive geological research continues to prove fruitless. A conservative policy rather than one of intensive development seems indicated, especially in view of the national importance of this mineral asset. Owing to a rise in the average value of the rupee, the sterling value of the output for 1925 exceeded that for 1924 by £181,494.

As was to be expected the Yenangyaung field of Upper Burma is mainly responsible for the present decrease in output. In 1924 it succeeded in shewing an increase of nearly 6½ million gallons but this temporary arrest in the decline is more than balanced by the drop in 1925 of over 21½ million gallons. It is interesting to note that of the 160 million gallons produced in Yenangyaung no less than 2,433,657 gallons were derived from the old Burmese hand-dug wells. It is now seldom that a new well strikes a yield of over 100 barrels per initial twenty-four hours. The utilization of the shallow oil-sands of this field, which were shut off during the competitive rush for the richer deep sands, continues; several remunerative wells are now being worked at depths a little above or below 400 feet, but in spite of the fact that the fall in their yields is unexpectedly gradual, the effect in delaying the decline of the field may be looked upon as almost negligible. The electrification of the field, which reached its limit of practicability in 1924, has added and is adding an appreciable contribution to the production figure, owing to the saving of a considerable quantity of crude oil formerly used as fuel beneath rig boilers. Of the nine companies operating in this small field the Burmah Oil Company produce about four-fifths of the total. Of undrilled portions of the Yenangyaung field the northern areas are shewing more promise than the southern.

During the year there were 21 outbreaks of fire, from which no serious loss or damage to life or property resulted. Out of 25 accidents reported during 1925, 10 were fatal.

The place of Yenangyaung is being steadily taken by the Singu field, which in a few years will undoubtedly usurp the premier position so far held by the older field. Singu, the greater part of which is in the hands of the Burmah Oil Co., is used to make good the deficiencies of Yenangyaung, in order to maintain supplies to the refinery. Singu produced 15½ million gallons more in 1925 than in 1924. Many wells are producing from the 3,000-foot sand and initial yields of 500 barrels and over are not uncommon. Steps are now being taken to electrify the Singu field.

The Yenangyat field has now reduced itself to the status of the Thayetmyo field and is outclassed by Minbu. Some deep tests are now being sunk in this field in the hope of reviving production. A scheme is under consideration by which the sandbank stretching southwards from the wells at Lanywa into the river Irrawaddy is to be protected by a revetted embankment. This, it is hoped, will enable a number of wells to be drilled by the Indo-Burma Petroleum Company on the sand-bank. As remarked in the Review of Mineral Production for 1920[1] the striking of remunerative supplies of oil at Lanywa makes it almost certain that the river Irrawaddy covers oil deposits of commercial size. The sand-bank which stretches from Lanywa to Sitpin is a more or less permanent feature, dry during the winter but covered by the floods of the rainy season. Large artificial mounds will probably have to be built to carry the derricks. Strictly speaking, the area belongs to the Singu dome area, but officially it will be looked upon as part of the Yenangyat field.

Of the other Burma fields, Minbu again shews a decline as also does Thayetmyo. The production from the Kindat area of the Upper Chindwin which had increased in 1924 fell a little in the year under review. The Arakan fields maintained their usual small output.

In Assam prospects are a little brighter. The Badarpur field, which had proved to be somewhat below expectations, increased its output by over 1 million gallons; further efforts in Lower Assam have raised hopes of an extension in development. The Digboi

[1] *Rec. Geol. Surv. Ind*, Vol. LIII, p. 117.

field in Upper Assam again shewed a marked increase amounting to over 4¾ million gallons; careful geological investigations by the Assam Oil Company's staff arouse expectations of a successful expansion of this field.

In the Punjab there is less cause for satisfaction. The output from the Khaur field has again dropped, this time to the extent of 3⅓ million gallons. The Burmah Oil Company have abandoned their test in the Khairpur State after exploring to the greatest depth at which any possibility of production was thought possible.

There was a slight fall in the imports of kerosene. Those from the United States were some 9,721,000 gallons less than they were in 1924, while the decrease in oil obtained from Georgia was not much less. Supplies from Borneo were doubled and there were marked increases in the case of Russia, the Straits Settlements, Sumatra and other countries.

The quantity of fuel oil imported into India during 1925 was, as Table 22 will shew, some 2½ million gallons less than that received during the previous year. As before something like four-fifths of the supply is derived from Persia, and the greater part of the rest comes from Borneo.

The export of paraffin wax increased to the extent of 2,176 tons during 1925 (see Table 23).

TABLE 20.—*Quantity and value of Petroleum produced in India during 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13·9).		Quantity.	Value. (£1 = Rs. 13·3).	
	Gals.	Rs.	£	Gals.	Rs.	£
Assam—						
Badarpur	3,277,829	7,41,074	53,315	4,281,878	11,17,012	83,986
Digboi	9,697,420	16,56,042	119,183	14,448,534	24,68,291	185,586
Burma—						
Akyab	7,014	2,024	145	7,169	2,483	187
Kyaukpyu	14,708	14,911	1,073	14,361	15,111	1,136
Minbu	3,829,044	9,57,261	68,868	3,248,566	9,13,659	68,696
Singu	79,938,430	2,99,76,911	2,156,612	95,262,519	3,57,23,445	2,685,973
Thayetmyo	1,717,653	5,36,707	38,616	1,320,009	3,71,253	27,914
Upper Chindwin.	1,474,898	1,10,617	7,958	1,385,977	1,03,948	7,816
Yenangyat	1,594,517	3,98,629	28,678	1,562,444	4,39,437	33,040
Yenangyaung	181,636,739	6,78,32,646	4,880,046	160,027,885	5,97,85,227	4,495,130
Punjab—						
Attock	11,383,240	28,45,810	204,735	8,047,200	20,11,800	151,263
Mianwali	200	50	4	..	..	..
Total	**294,571,692**	*10,50,73,342*	*7,559,233*	**239,606,542**	*10,29,51,666*	*7,740,727*

TABLE 21.—*Imports of Kerosene during 1924 and 1925.*

	1924.			1925.		
	Quantity	Value (£1 = Rs. 13·9).		Quantity.	Value (£1 = Rs. 13·3).	
	Gals	Rs.	£	Gals.	Rs.	£
From—						
Borneo .	7,355,960	36,48,433	262,477	14,867,813	78,89,050	593,161
Georgia .	9,242,682	56,46,665	406,235	996,975	5,14,065	38,652
Russia . .	..	..	..	3,313,667	19,12,876	143,825
Straits Settlements (including Labuan).	1,310	735	53	2,353,802	16,32,683	122,758
Sumatra .	..	..	..	1,148,962	7,35,087	55,270
United States of America.	55,206,946	3,75,05,896	2,698,266	45,485,437	3,13,73,754	2,358,929
Other Countries	677	1,286	92	2,198,407	17,04,787	128,180
Total .	71,807,575	*4,68,03,015*	*3,367,123*	70,345,064	*4,57,62,302*	*3,440,775*

TABLE 22.—*Imports of Fuel Oils into India during 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13·9).		Quantity.	Value (£1 = Rs. 13·3).	
	Gals.	Rs.	£	Gals.	Rs.	£
From—						
Persia . .	69,900,473	1,34,07,629	964,578	69,701,096	1,38,98,930	1,045,032
Straits Settlements (including Labuan).	2,136,548	7,35,360	52,904	2,243,702	6,94,045	52,184
Borneo . .	16,986,682	41,28,141	296,988	14,599,813	48,39,013	363,836
Other Countries	129,259	18,779	1,351	55,155	13,840	1,040
Total .	89,152,962	*1,82,89,909*	*1,315,821*	86,599,766	*1,94,45,828*	*1,462,092*

TABLE 23.—*Exports of Paraffin Wax from India during 1924 and 1925.*

To—	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13·9).		Quantity.	Value (£1 = Rs. 13·5).	
	Tons.	Rs.	£	Tons.	Rs.	£
Australia and New Zealand.	1,489	6,77,718	48,756	1,715	8,21,474	61,765
Belgium . . .	3,065	13,94,575	100,329	3,135	14,26,385	107,247
China . .	2,141	9,34,908	67,259	3,369	17,51,645	131,703
Japan . . .	4 387	19,96,070	143,602	315	1,43,525	10,791
Portuguese East Africa	2,040	9,28,200	66,777	2,835	12,89,925	96,987
Union of South Africa .	2,441	11,10,155	79,867	2,019	9,18,531	69,062
United Kingdom .	8,191	37,21,965	267,767	12,202	55,80,520	419,588
United States of America	625	2,84,318	20,455	915	4,18,600	31,474
Other Countries . .	5,028	23,28,909	167,549	5,018	22,69,282	170,623
Total .	**29,407**	*1,33,76,818*	*962,361*	**31,583**	*1,46,19,887*	*1,099,240*

Ruby, Sapphire and Spinel.

Although the severe decline in the output from the Mogok ruby mines of Upper Burma recorded in the preceding Review was not repeated in 1925, there was a marked drop in value which denotes a serious decline in the industry. Since the close of the year the mines have in fact closed down. The total weight of rubies mined in 1925 was more than twice that of the previous year, but the total value in 1925 was not much more than three-quarters of what it was in 1924. The average value per carat of the three stones taken together fell from Rs. 4·8 (£0·34) in 1924 to Rs. 2·4 (£0·18) in 1925.

TABLE 24.—*Quantity and value of Ruby, Sapphire and Spinel produced in India during 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13·9).		Quantity	Value (£1 = Rs. 13·3).	
	Carats.	Rs.	£	Carats.	Rs.	£
Burma. . . .	53,511 (Rubies)	4,22,240	30,377	109,998 (Rubies)	3,40,689	25,616
	37,942 (Sapphires)	57,556	4,141	31,508 (Sapphires)	20,616	1,550
	9,644 (Spinels)	3,544	255	7,531 (Spinels)	3,834	288
Total .	101,097	*4,83,340*	*34,773*	149,037	*3,65,139*	*27,454*

Salt.

Again a decrease in the output of salt has to be recorded, amounting to over 328,000 tons, Bombay, Sind, Northern India and Madras all contributing to the fall as before; Aden again shewed an increase, amounting to some 9,300 tons.

TABLE 25.—*Quantity and value of Salt produced in India during the years 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13 9).		Quantity.	Value (£1 = Rs. 13 3).	
	Tons.	Rs	£	Tons	Rs.	£
Aden	179,182	8,61,291	61,963	188,493	9,10,379	68,450
Bombay and Sind . .	538,777	29,35,188	211,165	381,419	20,43,490	153,646
Burma	20,557	2,63,586	18,963	22,880	3,23,116	24,294
Gwalior . . .	151	8,230	592	141	7,388	556
Kashmir . . .	(*a*)	152	11	..	..	..
Madras . . .	407,544	27,32,822	196,606	336,005	21,06,161	158,358
Northern India . .	477,264	29,38,703	211,417	365,606	22,52,021	169,324
TOTAL .	1,623,475	*97,39,972*	*700,717*	1,295,144	*76,42,555*	*574,628*

The total decrease includes a decrease in the output of rock-salt amounting to 38,857 tons.

TABLE 26.—*Quantity and Value of Rock-salt produced in India during 1924 and 1925.*

	1924.			1925		
	Quantity	Value (£1 = Rs. 13·9)		Quantity.	Value (£1 = Rs. 13·3)	
	Tons.	Rs.	£	Tons.	Rs.	£
Salt Range .	160,040	8,16,218	58,723	125,470	6,39,896	48,113
Kohat . . .	24 485	78,801	5,669	19,971	63,951	4,808
Mandi . . .	4,703	1,33,913	9,634	4,939	1,11,239	8,364
TOTAL .	189,237	10,28 962	74,026	150,380	8,15,086	61,285

There was a decrease of 54,525 tons in the imports of salts for which Aden and Egypt were chiefly responsible. The receipt from Italian East Africa and smaller contributors were also less, while imports from Germany and Spain shewed a large increase.

TABLE 27.—*Imports of Salt into India during the years 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13·9).		Quantity.	Value (£1 = Rs. 13·3).	
From—	Tons.	Rs.	£	Tons.	Rs.	£
United Kingdom .	100,075	26,19,905	188,482	100,702	19,61,799	147,503
Germany . . .	26,417	7,06,848	50,852	49,921	12,02,529	90,416
Spain . . .	12,247	2,55,264	18,364	39,321	7,91,260	59,493
Aden and Dependencies	221,005	49,91,205	359,079	176,961	31,49,730	236,822
Egypt . . .	154,123	35,62,448	256,291	113,085	21,20,211	159,414
Italian East Africa .	63,557	13,62,107	97,993	45,183	7,50,524	56,430
Other Countries . .	18,242	3,98,993	28,705	15,968	2,71,061	20,381
Total .	**595,666**	*1,38,96,770*	999,766	**541,141**	*1,02,47,114*	770,459

Saltpetre.

Owing to the withdrawal of restrictions on the manufacture of saline substances, reliable statistics of production are no longer available. Excepting some ten to twelve hundred tons required for internal consumption as fertilizer, almost the whole of the output is exported to foreign countries. The following table shows the distribution of saltpetre during the years 1924 and 1925.

TABLE 28.—*Distribution of Saltpetre exported from India during the years 1924 and 1925.*

To—	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13·9).		Quantity.	Value (£1 = Rs. 13·3).	
	Cwts.	Rs.	£	Cwts.	Rs.	£
Ceylon	68,518	8,62,089	62,021	70,978	8,76,326	65,889
Hongkong	35,597	7,97,507	57,375	21,356	4,72,040	35,492
Mauritius and Dependencies.	36,194	6,49,088	46,697	8,828	1,72,724	12,987
Straits Settlements (including Labuan).	4,795	1,08,192	7,783	4,652	90,743	6,823
United Kingdom	15,988	2,30,014	16,548	16,962	2,36,172	17,757
Other Countries	6,608	1,52,323	10,958	4,197	1,15,296	8,669
Total	**167,700**	*27,99,213*	*201,382*	**126,973**	*19,63,301*	*147,617*

Silver.

The production of silver from the Bawdwin mines of Upper Burma, which had increased to 5,287,711 oz. valued at Rs. 1,12,26,868 (£807,688) in 1924, fell to 4,831,548 oz. valued at Rs. 93,36,580 (£701,998), figures a little less than those for 1923. A further increase in the output of silver amounting to 3,610 oz. is reported from the Kolar gold mines of Mysore.

TABLE 29.—*Quantity and value of Silver produced in India during 1924 and 1925.*

—	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13·9).		Quantity.	Value (£1 = Rs. 13·3).	
	Oz.	Rs.	£	Oz.	Rs.	£
Burma—						
Northern Shan States	5,287,711	1,12,26,868	807,088	4,831,548	93,36,580	701,998
Madras—						
Anantapur .	240	493	35	21	38	3
Mysore—						
Kolar . . .	21,243·4	43,725	3,146	24,853·3	46,571	3,502
Total .	5,309,203·4	*1,12,71,086*	*810,869*	4,856,422·3	*93,83,189*	*705,503*

Tin.

According to the revised production figure for 1924, which is some 84 tons less than that published in the preceding review, there was a total increase of 428 tons of tin in 1925. The total production of 2,308 tons was derived from Burma, Tavoy contributing 72·8 per cent. and Mergui 26·9 per cent. There is no recorded output of block tin. The testing of a new part of the Amherst district, in the Kya-in township, will be watched with interest. Imports of unwrought tin increased considerably, the figure for 1925 being 6,785 cwts. greater than that for 1924 (*see* Table 31); 97 per cent. of these imports came from the Straits Settlements. The quantity of wrought tin imported into India amounted in 1925 to 1,385 cwts. valued at Rs. 2,61,638 (£19,672) against 3,768 cwts. valued at Rs. 1,71,636 (£12,348) in 1924.

TABLE 30.—*Quantity and value of Tin-ore produced in India during the years 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1=Rs. 13·9).		Quantity.	Value (£1=Rs. 13·3).	
	Tons.	Rs.	£	Tons.	Rs.	£
Burma—						
Amherst . . .	3·7	5,000	403	2	3,800	286
Mergui . . .	(*a*) 439·1	8,21,982	59,135	621	10,47,511	78,760
Tavoy . . .	1,433·0	20,61,107	148,281	1,680	25,06,170	188,434
Thaton . . .	(*a*) 4·0	5,000	360	5	6,000	451
Total .	1,879·8	*28,93,695*	*208,179*	2,308	*35,63,481*	*267,931*

(*a*) Revised.

TABLE 31.—*Imports of unwrought Tin (blocks, ingots, bars and slabs) into India during 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1=Rs. 13 9).		Quantity.	Value (£1=Rs. 13·3).	
From—	Cwts.	Rs.	£	Cwts.	Rs.	£
United Kingdom .	2,807	4,92,489	35,431	1,363	2,43,393	18,300
Straits Settlements (including Labuan).	45,301	72,89,478	524,423	53,607	91,76,670	689,975
Other Countries .	366	52,350	3,766	289	53,056	3,989
TOTAL .	48,474	*78,34,317*	*563,620*	55,259	*94,73,119*	*712,264*

Tungsten.

There was an increase of 33 tons in the production of wolfram, but this was still 100 tons short of the figure for 1923. The whole of the output was derived from Tavoy.

TABLE 32.—*Quantity and value of Tungsten-ore produced in India during 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13·0).		Quantity.	Value (£1 = Rs. 13·3).	
	Tons.	Rs.	£	Tons.	Rs.	£
Burma—						
Mergui . . .	0·3	91	6	..	..	..
Tavoy . . .	738·7	3,41,290	24,553	772·2	4,51,864	33,975
TOTAL .	739 0	*3,41,381*	*24,559*	772·2	*4,51,864*	*33,975*

Zinc.

16,810 tons of zinc concentrates were produced by the Burma Corporation Ltd., in the Northern Shan States during the year under review. The exports amounted to 20,967 tons valued at Rs. 20,79,794 (£156,375). The increase in the exports over production is due to the accumulation of stocks in the previous year when 18,650 tons were produced but 15,192 tons, valued at Rs. 11,60,449 (£83,486) were exported.

III.—MINERALS OF GROUP II.

Alum.

The alum industry of the Mianwali district, Punjab, has not yet recovered from the severe decline since 1922, but the figures for 1925 shew a slight improvement over those for the previous year. The output during the year under review amounted to 1,050 cwts. valued at Rs. 22,848 (£1,718) against 926·5 cwts. valued at Rs. 18,900 (£1,359) in 1924.

Amber.

There was a large decrease in the production of amber in the Myitkyina district, Burma, which amounted to 16·1 cwts. valued at Rs. 9,440 (£710), against 89·3 cwts. valued at Rs. 15,301 (£1,101) in 1924.

Antimony.

An output of 10 tons valued at Rs. 345 (£26) was reported from the Amherst district in Burma. No production from this area is recorded since 1917 when 105 tons were raised; in 1916 the district was responsible for 1,000 tons from two or three different localities.

Apatite.

There was a considerable decrease in the output of apatite in Singhbhum, which amounted to 1,480 tons valued at Rs. 11,300 (£850), against 6,426 tons, valued at Rs. 68,004 (£4,892) in 1924. The development of the Singhbhum deposits is restricted by the small demand in India for this phosphate fertiliser.

Asbestos.

There was a further decrease in the production of asbestos which amounted to only 16 tons valued at Rs. 4,796 (£361), against 125·3 tons valued at Rs. 18,826 (£1,354) in 1924. The production was derived from the Cuddapah district in the Madras Presidency. The mines in the Seraikela State of Bihar and Orissa and in the Bhandara district of the Central Provinces from which an output of asbestos was reported in the previous year were not worked during the year under review.

Barytes.

The output of barytes from the Kurnool district of Madras and the Alwar State of Rajputana fell further from a total of 2,303 tons valued at Rs. 31,341 (£2,255) in 1924 to 1,450 tons valued at Rs. 17,660 (£1,328). Of this 580 tons were reported from Kurnool and the balance from the Alwar State.

Bauxite.

The output of bauxite fell from 23,228 tons valued at Rs. 1,88,075 (£13,531) in 1924 to 10,070 tons valued at Rs. 84,055 (£6,320) in 1925; the details of production are shown in the accompanying table. The figure for 1924 was, however, a record output more than double that of any other year; the figure for 1925 is still considerably in excess of the average for the four years previous to 1924.

TABLE 33.—*Quantity and value of Bauxite produced in India during 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13·9).		Quantity.	Value (£1 = Rs. 13·3).	
	Tons.	Rs.	£	Tons.	Rs.	£
Bombay—						
Belgaum	..	..	..	1,500	8,250	620
Kaira	19,738	1,77,640	12,780	6,967	66,186	4,977
Central Provinces—						
Jubbulpore	3,490	10,435	751	1,603	9,619	723
TOTAL	23,228	1,88,075	13,531	10,070	84,055	6,320

Table 34.—*Production of Building Materials and Road Metal in India during 1925.*

(The value in sterling pounds has been calculated on the basis of £1 = Rs. 13 3.)

	Granite and Gneiss.		Laterite.		Lime.		Limestone and Kankar.		Marble.		Sandstone.		Slate.		Trap.		Miscellaneous.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£
Assam	13,473	2,227	6,362	988	..	..	75,550	11,444	..	..	..	..	..	..	..	..	55,877	13,223
Baluchistan	..	..	.	..	..	..	2	14	..	..	..	..	..	..	..	..	..	..
Bengal	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	95,537	10,752
Bihar and Orissa	7,162	700	1,874	44	..	..	(a)921,981	163,095	..	..	9,949	732	2,108	2,605	22,143	3,277	185,119	10,714
Bombay	..	..	4,700	793	..	..	..	..	..	..	7,750	977	..	..	950	180	391,658	52,829
Burma	496,136	73,327	177,707	20,155	..	..	219,525	23,220	..	..	81,209	10,279	..	..	..	..	668,222	60,413
Central India	..	..	..	..	12,635	12,453	93,875	6,480	..	..	..	..	230	34	..	..	6,257	2,819
Central Provinces	..	..	..	..	362	381	361,062	43,558	..	..	4,668	1,322	..	..	..	..	..	..
Gwalior	..	..	..	..	..	..	..	..	..	..	18,127	4,104	..	..	..	..	..	..
Kashmir	..	..	..	..	..	..	159	338	..	..	..	..	..	13	..	..	12,369	1,923
Madras	8,211	121	93,331	3,750	..	..	13,996	1,242	..	..	..	..	..	..	..	..	100,345	5,824
Mysore	..	..	..	..	428	359	(b)10,073	2,363	..	..	..	..	..	..	..	..	2,891	978
N.-W. F. Province	..	..	..	..	..	..	2,841	202	..	..	..	..	..	..	..	..	..	..
Punjab	..	..	..	..	..	..	48,247	4,642	..	..	..	..	6,790	10,357	..	..	45,904	3,565
Rajputana	..	..	..	..	..	..	(c)152,890 (d)	14,649	5,651	14,767	178,540	60,224	450	85	..	..	41,041	2,473
United Provinces	..	..	..	..	..	..	1,208,509	116,070	..	..	10,700	3,039	15,449	662	..	..	729,181	79,046
Total	**524,982**	*76,375*	**283,974**	*25,730*	**13,425**	*13,193*	**3,108,710**	*381,317*	**5,651**	*14,767*	**310,943**	*80,677*	**25,027**	*13,756*	**23,093**	*3,457*	**2,334,401**	*244,579*

(a) Includes 316,580 tons of dolomite valued at Rs. 8,36,782.
(b) Includes 782 tons of manganiferous limestone valued at Rs. 6,262.
(c) Includes 8 tons of dolomite valued at Rs. 65.
(d) Includes 1,178,212 tons of *kankar* used for metalling roads.

Building Materials and Road-metal.

The total estimated value of building stone and road-metal produced in the year under consideration was Rs. 1,13,56,215 (£853,851) (see Table 34). Certain returns supplied in cubic feet have been converted into tons on the basis of certain assumed relations between volume and weight. The total production of 3,108,710 tons shown under "Limestone and Kankar," includes the production of dolomite. On enquiry it has been ascertained that dolomite is not at present produced in British India but is restricted only to Indian States. Of the total production of 316,588 tons of dolomite, 316,580 tons were produced in the Gangpur State in Bihar and Orissa mainly for use as flux in iron industries and the remaining 8 tons in the Jaisalmer State in Rajputana for the manufacture of lime. The high figure of 1,208,509 tons shown against the United Provinces represents the production of 22,605 tons of limestone used for lime and 1,185,904 tons of *kankar*, of which 1,178,212 tons were used for metalling roads and the rest for the manufacture of lime.

Clay.

The recorded production of clay rose from 122,972 tons, valued at Rs. 3,49,979 (£25,178) in 1924 to 128,860 tons, valued at Rs. 2,89,875 (£21,795) in 1925 (see Table 35). The increase in quantity was, however, more than offset by a considerable decrease in value.

TABLE 35.—*Production of Clays in India during 1925.*

	Quantity.	Value (£1 = Rs. 13·3).	
	Tons.	Rs.	£
Bengal	43,602	44,900	3,376
Bihar and Orissa	32,116	1,68,186	12,646
Burma	25,184	32,895	2,473
Central India	1,223	4,003	301
Central Provinces	17,820	9,407	707
Delhi	2,133	2,256	170
Gwalior	579	6,669	501
Kashmir	1,147	1,920	144
Madras	708	4,038	304
Mysore	3,786	14,294	1,075
Rajputana	562	1,307	98
Total	**128,860**	**2,89,875**	**21,795**

Copperas. A quantity of 8 cwts. of sulphate of iron valued at Rs. 14 (£1) was produced from the Khardang mine in Ladakh *tehsil*, Kashmir State.

Corundum. An output of 10 tons of corundum was reported from the Bhandara district in the Central Provinces. The value of the production is not available.

Fuller's Earth. In 1923 there was an unusually large production of Fuller's earth amounting to nearly 27,700 tons. This fell in 1924 to the more normal figure of 4,078 tons and has again fallen to 2,198 tons, a figure not far from the average for the three years 1919-1921. Mysore is chiefly responsible for the fall in 1925, which, however, is partly due to the illiteracy of the workers and consequenti ncompleteness of returns; Jodhpur again shows a decline.

TABLE 36.—*Production of Fuller's Earth in India during 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13·9).		Quantity.	Value. (£1 = Rs. 13·3).	
	Tons.	Rs.	£	Tons.	Rs.	£
Central Provinces—						
Jubbulpore . .	19	93	7	59	289	22
Mysore . . .	2,534	364	26	143	364	27
Rajputana—						
Bikanir . .	450	2,010	145	1,180	7,080	533
Jaisalmer . .	5	85	6	20	310	23
Jodhpur . .	1,070	13,475	969	796	13,434	1,010
Total .	**4,078**	***16,027***	***1,153***	**2,198**	***21,477***	***1,615***

Gypsum. There was again a slight fall in the output of gypsum, from 38,123 tons valued at Rs. 76,838 (£5,527) in 1924 to 36,244 tons valued at Rs. 77,270 (£5,810) in 1925. The effect of gypsum in small quantities upon crops—a common application is 2 maunds to the acre—is said to be remarkable and its usefulness to the monsoon crops of South Bihar has been

experimentally demonstrated.[1] The Department of Agriculture, Bihar and Orissa, is importing annually increasing amounts of gypsum from Jamsar in Bikanir. This experimental work may, therefore, result in a demand from agricultural districts for gypsum.

TABLE 37.—*Production of Gypsum in India during 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1 = Rs. 14·9).		Quantity.	Value (£1 = Rs. 13·3).	
	Tons.	Rs.	£	Tons.	Rs.	£
Kashmir . .	48	600	43	132	275	21
Punjab—						
Jhelum . .	4,927	4,927	354	1,688	3,411	256
Rajputana—						
Bikanir . .	26,698	55,851	4,018	26,804	57,784	4,345
Jaisalmer . .	125	823	59	120	800	60
Jodhpur . .	6,325	14,647	1,053	7,500	15,000	1,128
Total .	**38 123**	*76,838*	*5,527*	**36,244**	*77,270*	*5,811*

The output of ilmenite from Travancore State fell further from 641 tons, valued at £1,381 in 1924 to 328 tons, valued at £492 in 1925.

Ilmenite.

There was a very large increase in the production of refractory materials. The output rose from 224 tons valued at Rs. 3,360 (£242) in 1924 to 6,182 tons valued at Rs. 40,192 (£3,022). Of this 2 tons were produced in the Manbhum district, 343 tons from the Lapso Hills mines in Kharsawan State (Singhbhum), by the Indian Copper Corporation Ltd. and the balance from the Ghagidih and Mosaboni Mines in Singhbhum worked by Mr. E. O. Murray and the Indian Copper Corporation Ltd., respectively.

Kyanite.

There was a further decrease in the production of ochre from 6,304 tons, valued at Rs. 66,719 (£4,800) in 1924 to 5,296 tons, valued at Rs. 37,023 (£2,784) in 1925.

Ochre.

[1] D. Clouston. Review of Agricultural Operations in India, 1924-25, p. 52.

TABLE 38.—*Production of Ochre in India during 1924 and 1925.*

	1924.			1925		
	Quantity.	Value (£1 = Rs. 13·9).		Quantity.	Value (£1 = Rs. 13·3).	
	Tons.	Rs	£	Tons.	Rs.	£
Bihar and Orissa .	300	7,665	551	..	..	..
Central India . .	4,400	40,760	2,932	4,303	24,455	1,839
Central Provinces .	184	2,698	194	119	2,410	181
Gwalior . . .	783	10,571	761	230	4,937	371
Madras . .	325	4,375	315	340	4,600	346
Rajputana . . .	312	650	47	304	621	47
Total .	6 304	66 719	4 800	5,296	37,023	2,781

Oil Shale.

An output of 40 tons of oil shale valued at Rs. 200 (£15) was reported for the first time from the Amherst district in Burma.

Phosphate (*see* **Apatite**).

Rock crystal.

An exceptionally fine crystal of transparent quartz recently came to light in Burma. A ball, 30 inches in diameter and 130 lbs. in weight, was cut from the mass in China polished in Japan and has found its way to the United States National Museum at Washington. The crystal is presumed to have come from the Sakangyi area near Mogok.

Serpentine.

The production of serpentine in the Ladak *tahsil*, Kashmir State, rose from 1·8 tons valued at Rs. 75 (£5·4) in 1924 to 2·6 tons valued at Rs. 105 (£8) in 1925.

Soda.

There was a further increase in the production of soda in the Ladak *tahsil*, Kashmir, from 11·8 tons, valued at Rs. 430 (£31), in 1924 to 28·3 tons, valued at Rs. 1,126 (£85) in the year under review. Salt, consisting for the greater part of sodium carbonate, sodium bicarbonate and sodium chloride, is obtained by evaporation from the waters of the Lonar lake in the Buldana district of the Central Provinces. It is known under the general name of *trona* or *urao*, for which there is no suitable equivalent in English. The total amount of *trona* extracted in 1925 was 35 tons, valued at Rs. 1,050 (£79) as against 20 tons, valued at Rs. 800 (£58) in 1924. There was also a produc-

tion of 3·4 tons of crude soda (*rasi*), valued at Rs. 82 (£7) in Datia State, Central India.

Steatite.

The great fall in the output of steatite in 1924 was followed by a slight fall in 1925 amounting to some 43 tons, but this was accompanied by an enormous increase in value the 1925 yield being estimated at double the value of that of 1924.

TABLE 39.—*Production of Steatite in India during 1924 and 1925.*

	1924.			1925.		
	Quantity.	Value (£1 = Rs. 13·9).		Quantity.	Value (£1 = Rs. 13·5).	
	Tons.	Rs.	£	Tons.	Rs.	£
Bihar and Orissa—						
Mayurbhanj .	67·0	6,200	447	90·0	8,350	628
Nilgiri . .	..	3,500	252	..	..	..
Seraikela . .	18·4	1,000	72	25·7	1,400	105
Singhbhum .	63·8	3,359	241	58·9	3,539	266
Burma—						
Pakokku Hill Tracts	7·1	1,950	141	3·1	800	60
Central Provinces—						
Bhandara . .	..	..	..	337·5	13,500	1,015
Jubbulpore . .	1,675·0	17,597	1,266	1,286·8	70,799	5,323
Madras						
Kurnool .	4·0	245	17	4·0	244	18
Nellore . .	1080	6,538	470	82·2	5,724	430
Salem . . .	804·0	19,748	1,421	712·8	16,697	[1,256
Mysore . . .	50·0	120	9	101·0	810	61
United Provinces—						
Hamirpur . .	37·0	8,050	579	31·0	7,040	530
Jhansi . .	18·0	864	62	76·0	770	58
Total .	**2,852·3**	*69,177*	*4,977*	**2 809·0**	*1,29,673*	*9,750*

(*a*) Estimated.

Sulphate of Iron (*see* **Copperas**).

Zircon.

There was a further increase in the production of zircon in the Travancore State, which rose from 365 tons, valued at £2,717 in 1924 to 576 tons valued at £4,608 in 1925.

IV.—MINERAL CONCESSIONS GRANTED.

TABLE 40.—*Statement of Mineral Concessions granted during the year 1925.*

AJMER-MERWARA.

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Ajmer	(1) Messrs. J. A. Begbie & Co.	Mica	P. L.	0 66	25th January 1925.	1 year.
Do.	(2) Do.	Do.	P. L. (renewal).	4·42	22nd June 1925.	Do.
Do.	(3) L. Kanahyaial, Nasirabad.	Do.	P. L.	4 22	19th August 1925.	Do.
Do.	(4) Do.	Do.	P. L.	3 00	Do.	Do.
Do.	(5) Messrs. Samsuddin and Sons of Nasirabad.	Do.	P. L.	1 59	25th August 1925.	Do.
Do.	(6) Do.	Do.	P. L.	3 97	Do.	Do.
Do.	(7) Mr. E. P. Thomas	Do.	P. L.	6·76	10th September 1925.	Do.
Do.	(8) Do.	Do.	P. L.	0 66	Do.	Do.
Do.	(9) L. Prem Sukh Rathi of Nasirabad.	Do.	P. L.	14·17	23rd September 1925.	Do.
Do.	(10) Do.	Do.	P. L.	0 83	1st December 1925.	Do.
Do.	(11) Do.	Do.	P. L.	5·55	5th December 1925.	Do.
Do.	(12) Begbie Mining Syndicate.	Do.	M. L.	6·02	1st June 1925	5 years.
Do.	(13) Mr. E. P. Thomas	Do.	M. L.	*	14th November 1925.	3 years.
Beawar	(14) Rajputana Minerals & Co., Ltd., Bombay.	Graphite	P. L.	6 05	17th December 1925.	1 year.
Do.	(15) M. Mohamed Fazal of Ajmer.	Mica	P. L. (renewal).	0·22	12th June 1925.	Do.

ASSAM.

Cachar	(16) Craig Park Tea Company, Limited.	Mineral oil	P. L.	1,915·58	5th May 1925	2 years.
Do.	(17) Whitehall Petroleum Corporation, Limited.	Crude petroleum and its associated hydrocarbons.	P. L.	11,968	9th February 1925.	1 year.
Khasi and Jaintia Hills.	(18) John Buchanan Beattie.	Coal	M. L.	5,817·6	4th September 1925.	30 years.
Do.	(19) Mr. P. N. Sen	Mineral oil	P. L.	2,518	9th October 1925.	2 years.

P. L. = *Prospecting Licence.* *M. L.* = *Mining Lease.*
* Whole of the Bavri Estate.

ASSAM—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Lakhimpur .	(20) Assam Oil Company, Ltd.	Oil . . .	P. L. . (renewal).	5,120	30th March 1925.	1 year.
Do. .	(21) Do. .	Do. . . .	P. L. . (renewal).	4,480	7th April 1925	Do.
Do .	(22) Do. .	Do. . . .	P. L. . (renewal).	4,160	20th April 1925.	Do.
Do. .	(23) Do. .	Do. . . .	P. L. . (renewal).	3,968	12th May 1925.	Do.
Do. .	(24) Do. .	Do. . . .	P. L. . (renewal).	9,792	7th October 1925.	Do.
Do. .	(25) Do. .	Coal . . .	P. L. . (renewal).	3,328	5th February 1925.	Do.
Do. .	(26) Do. .	Do. . . .	P. L. .	9,792	7th October 1925.	Do.
Naga Hills .	(27) Whitehall Petroleum Corporation, Limited.	Mineral oil . .	P. L. .	7,180·8	16th September 1925.	Do.
Do. .	(28) Do. .	Do. . .	P. L. .	4,211·2	Do.	Do.
Nowgong .	(29) Do. .	Oil and its associated hydrocarbons.	P. L. .	1,344	9th April 1925.	Do.
Do. .	(30) Do. .	Do. .	P. L. .	5,050	3rd March 1925.	Do.
Do. .	(31) Do. .	Do. .	P. L. . (renewal).	1,344	20th March 1925.	Do.
Do. .	(32) Do. .	Do. .	P. L. . (renewal).	1,920	Do.	Do.
Sadiya Frontier Tract	(33) Assam Oil Company, Limited.	Mineral oil . .	P. L. .	2,240	19th December 1925.	Do.
Sibsagar .	(34) Do. .	Coal and oil .	P. L. .	1,440	5th June 1925.	Do.
Do .	(35) Burmah Oil Company, Limited.	Do. .	P. L. .	6,400	9th June 1925.	Do.
Sylhet .	(36) Do. .	Mineral oil . .	P. L. .	11,945	10th December 1925.	2 years.
Do. .	(37) Do. .	Do. . .	P. L. .	3,160	Do. .	Do.
Do .	(38) Do. .	Do. . .	P. L. .	3,136	3rd May 1925	1 year.

BALUCHISTAN.

Kalat .	(39) The Burmah Oil Co., Ltd., Scotland.	Mineral Oil . .	P. L. .	3,200	1st September 1920.	8 years.
Do. .	(40) Do. .	Do. . .	E. L. .	Not known	2nd October 1924.	1 year.
Zhob . .	(41) The Baluchistan Chrome Co., Ltd., Hindubagh.	Chromite . .	M. L. .	10	20th March 1925.	30 years.

P. L. = *Prospecting License*, *M. L.* = *Mining Lease*. *E. L.* = *Exploring License*,

BENGAL.

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Chittagong .	(42) Whitehall Petroleum Corporation Ltd.	Natural petroleum	P. L. .	3,061·98	16th June 1925.	1 year.
Chittagong Hill Tracts	(43) Burmah Oil Co., Ltd.	Mineral oil . .	P. L. . (renewal.)	9,600	7th March 1925.	Do.
Do. .	(44) Do. .	Do. . .	P. L. . (renewal.)	7,719 04	Do. .	Do.
Do. .	(45) Whitehall Petroleum Corporation Ltd.	Do. . .	P. L. . (renewal.)	4,601·6	14th April 1925.	Do.
Do. .	(46) Burmah Oil Co., Ltd.	Do. . .	P. L. . (renewal.)	4,313·6	9th October 1925.	Do.
Do. .	(47) Whitehall Petroleum Corporation Ltd.	Do. . .	P. L. . (renewal.)	2,912	3rd September 1925.	Do.
Do. .	(48) Do. .	Do. . .	P. L. . (renewal.)	5,401·6	14th April 1925.	Do.

BIHAR AND ORISSA.

Hazaribagh.	(49) Kumar Krishna Mitra.	Mica . . .	M. L. .	Not available	1st November 1925.	2 years.
Patna .	(50) Mr. D. C. Nag .	All minerals .	P. L. .	3,552	16th December 1925.	1 year.
Santal Parganas.	(51) Bhudar Chandra De.	Coal . . .	M. L. .	3·94	1st April 1925.	2 years.
Do. .	(52) Bhode Behari De	Do. . . .	M. L. .	2·15	Do. .	Do.
Do. .	(53) Ramrekh Das Merwari.	Do. . . .	M. L. .	0 99	Do. .	Do.
Do. .	(54) Bansi Ram Merwari.	Do. . . .	M. L. .	1 90	Do. .	Do.
Do. .	(55) Do. .	Do. . . .	M. L. .	5 00	Do. .	Do.
Do. .	(56) Ganga Ram Merwari.	Do. . . .	M. L. .	2·48	Do. .	Do.
Do. .	(57) Ramrekh Das Merwari.	Do. . . .	M. L. .	4·27	Do. .	Do.
Do. .	(58) Jetha Mulji .	Do. . . .	M. L. .	3·00	Do. .	Do.
Do. .	(59) Do. .	Do. . . .	M. L. .	5·00	Do. .	Do.
Do. .	(60) Bhudar Chandra De.	Do. . . .	M. L. .	0·99	Do. .	Do.
Do. .	61) Ramrekh Das Merwari.	Do. . . .	M. L. .	5·00	Do. .	Do.
Do. .	(62) Ganga Ram Merwari.	Do. . . .	M. L. .	5·04	Do. .	Do.
Do. .	(63) Bhudar Chandra De.	Do. . . .	M. L. .	1 00	Do. .	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

BIHAR AND ORISSA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Singhbhum	(64) Hira Lal Sarda .	Limestone . .	P. L. .	340·94	11th February 1925.	1 year.
Do. .	(65) Lalji Jhina & Sons.	Iron-ore . .	P. L. .	611·00	15th April 1925.	Do.
Do. .	(66) The Bengal Iron Company, Limited.	Iron-ore and Manganese.	M. L. .	1,139·76	7th March 1925.	30 years.
Do. .	(67) Kali Charan Trivedi.	Yellow Ochre .	M. L. .	6·79	1st April 1925.	3 years.
Do. .	(68) Satya Charan Mukharji.	All minerals .	P. L. .	115·20	24th July 1925.	1 year.
Do. .	(69) Do. .	Do. .	P. L. .	121	24th June 1925.	Do.
Do. .	(70) Arjune Ladha .	Do. .	P. L. .	125	18th December 1925.	Do.
Do. .	(71) Mangi Lal Merwari.	Chromite . .	P. L. .	332·50	23rd July 1925.	Do.
Do. .	(72) Messrs. Martin & Co.	Manganese . .	P. L. .	212 80	24th July 1925.	Do.
Do. .	(73) Mangi Lal Merwari.	Do. . .	M. L. .	402·71	12th December 1925.	20 years.

BOMBAY.

Belgaum .	(74) Mr. A. N. Peston Jamas.	Bauxite . .	P. L. .	1,072·92	24th March 1925.	1 year.
Do. .	(75) Rao Saheb D. C. Manikum.	Manganese . .	P. L. .	320	23rd November 1925.	6 months.
Kanara .	(76) Messrs. D. M. Tilve and Sons.	Do. . .	P. L. .	264	29th September 1925.	1 year.
Do. .	(77) Mr. K. Rama Chandra.	Do. . .	P. L. .	1,584	17th August 1925.	Do.
Do. .	(78) Messrs. D. M. Tilve and Sons.	Do. . .	M. L. .	10·3	Not yet executed.	25 years.
Do. .	(79) Mr. T. B. Kantharia.	Do. . .	M. L. .	116	Do. .	3 years.
Sukkur .	(80) Indo-Burma Petroleum Company Limited.	Mineral oil . .	P. L. . (renewal).	6,008·52	1st September 1924.	1 year.
West Khandesh.	(81) Messrs. Ramgopal Jagannath.	Coal, white stones, Iron, Mica and Oils.	P. L. .	79·17	25th September 1925.	Do.

P. L. = Prospecting License. M. L. = Mining Lease.

BURMA.

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Akyab .	(82) The Burmah Oil Co., Ltd., Rangoon.	Natural petroleum.	P. L. .	1,280	2nd November 1925.	2 years.
Do. .	(83) The Indo-Burma Petroleum Co., Ltd., Rangoon.	Do. .	P. L. . (renewal).	5,440	15th December 1924.	1 year.
Do. .	(84) Do .	Do. .	P. L. . (renewal).	4,800	19th January 1925.	Do.
Do. .	(85) Do. .	Do. .	P. L. . (renewal).	1,280	22nd April 1925.	Do.
Do. .	(86) The Burmah Oil Co., Ltd., Rangoon.	Do. .	P. L. . (renewal).	3,630	16th July 1925.	Do.
Do. .	(87) Whitehall Petroleum Corporation, Lahore.	Natural petroleum and its associated hydrocarbon.	P. L. . (renewal).	5,120	19th September 1925	Do.
Amherst .	(88) D. A. David .	Sulphides . .	P. L. .	1,280	30th July 1925.	Do.
Do. .	(89) Do. .	Do. . .	P. L. .	1,280	30th January 1925.	Do.
Do. .	(90) S. H. Harman .	All minerals .	P. L. .	1,280	9th December 1925.	Do.
Do. .	(91) H. Bryant . .	All minerals except oil.	P. L. .	1,280	19th July 1925.	Do.
Do.	(92) D. A. David .	Do. .	P. L. .	640	4th February 1925.	Do.
Do.	(93) Chew Whee Shain	Do. .	P. L .	1,037	24th October 1925.	Do.
Do. .	(94) Saw Lein Lee .	Do. .	P. L.	1,280	16th September 1925.	Do.
Do. .	(95) H. Bryant . .	Do. .	P. L. .	1,920	15th September 1925.	Do.
Do. .	(96) Saw Lein Lee .	Antimony . .	P. L. .	1,600	5th June 1925.	Do.
Do. .	(97) Do. .	Do. . .	P L. .	1,248	17th June 1925.	Do.
Do. .	(98) M. E. Moolla .	Oil Shale . .	M. L. .	12,800	21st August 1925.	30 years.
Do. .	(99) D. A. David .	Antimony . .	M. L. .	269	23rd September 1925.	Do.
Do. .	(100) Messrs. Balthazar & Son.	Mineral oil . .	P. L. . (renewal).	5,760	24th February 1925.	1 year.
Do. .	(101) Dr. M. Shawloo.	Do. . .	P. L. . (renewal).	7,040	26th February 1925.	Do.
Bhamo .	(102) Messrs. Foucar & Co., Ltd., Managing Agents, The Tavoy Tin Syndicate, Ltd., Rangoon.	All minerals except natural petroleum and jade.	P. L. . (renewal).	826	24th January 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Kyaukpyu .	(103) Messrs. Finlay Fleming & Co., Managing Agents, The Burmah Oil Co., Ltd.	Natural Petroleum.	P. L. . (renewal).	1,280	1st June 1925.	1 year.
Kyaukse .	(104) Yeo Eng Byan .	Minerals other than mineral oil.	P. L. .	5,568	26th October 1925.	Do.
Do. .	(105) W. Kim Kyo .	Do. .	P. L. .	3,040	5th December 1925.	Do.
Lower Chindwin.	(106) U. P. Kyan .	Natural petroleum.	P. L. .	640	1st March 1925.	Do.
Do. .	(107) Mr. L. Dawson .	Do. .	P. L. . (renewal).	3,008	6th February 1925.	Do.
Do. .	(108) The Indo-Burma Petroleum Co., Ltd.	Do. .	P. L. . (renewal).	1,920	1st August 1925.	Do.
Do. .	(109) Do. .	Do. .	P. L. (renewal).	3,200	22nd September 1925.	Do.
Magwe .	(110) The Sanhla Oil Co.	Do. .	P. L. .	134	5th May 1925.	2 years.
Do. .	(111) Do. .	Do. .	P. L. .	640	2nd June 1925.	Do.
Do. .	(112) The Hesford Development Syndicate.	Do. .	P. L. .	640	12th June 1925.	Do.
Do. .	(113) U. Thu Daw .	Do. .	P. L. .	2,560	15th October 1925.	Do.
Do. .	(114) The Sanhla Oil Co.	Do. .	P. L. .	100	11th August 1925.	Do.
Do. .	(115) British Burma Petroleum Co.	Do. .	P. L. .	72	26th August 1925.	Do.
Do. .	(116) Upper Burma Oil Syndicate.	Do. .	P. L. . (renewal).	76	16th November 1924.	1 year.
Do. .	(117) U. Ye . .	Do. .	P. L. . (renewal).	640	10th November 1924.	Do.
Do. .	(118) Union Oil Co. .	Do. .	P. L. . (renewal).	3,840	21st January 1925.	Do.
Do. .	(119) Burmah Oil Co, Ltd.	Do. .	P. L. . (renewal).	2,259	25th June 1925.	Do.
Do. .	(120) Do. .	Do. .	P. L. . (renewal).	3,840	2nd June 1925.	Do.
Do. .	(121) Do. .	Do. .	P. L. . (renewal).	320	12th September 1925.	Do.
Do. .	(122) Do. .	Do. .	P. L. . (renewal).	560	Do.	Do.
Do. .	(123) Do. .	Do. .	P. L. . (renewal).	320	Do.	Do.
Do. .	(124) Upper Burma Oil Syndicate.	Do. .	P. L. . (renewal).	76	16th November 1925.	Do.

P. L. = *Prospecting License*, *M. L.* = *Mining Lease*.

BURMA—*contd.*

District.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Magwe .	(125) Upper Burma Oil Syndicate.	Natural petroleum.	P. L. . (renewal).	2,880	1st December 1925.	1 year.
Do. .	(126) Mr. Abdul Rahman.	Do. .	P. L. .	1,280	27th July 1925.	2 years
Do. .	(127) Burmah Oil Co., Ltd.	Do. .	P. L. .	82	*	Do.
Mandalay .	(128) Messrs. Steel Bros. & Co., Ltd., Rangoon.	All minerals except oil.	P. L. .	1,907	1st October 1925.	1 year.
Meiktila .	(129) Mr. S. S. Halkar.	Galena . .	P. L. .	307	26th May 1925.	Do.
Do. .	(130) Mrs. Grace Smith	All minerals except oil.	P. L. .	3,200	14th September 1925.	Do.
Do. .	(131) Mr. Colin Campbell.	Do. .	P. L. .	1,280	9th November 1925.	Do.
Do. .	(132) Burmah Oil Co., Ltd.	Natural petroleum.	P. L. . (renewal).	1,850	26th May 1925.	Do.
Mergui .	(133) Mr. A. M. G. Forbes.	Tin . . .	P. L. .	589	14th January 1925.	Do.
Do. .	(134) Mr. Lim Shain .	All minerals except oil.	P. L. .	655·3	10th September 1925.	Do.
Do. .	(135) Messrs. Burma Finance and Mining Co., Ltd.	Do. .	P. L. .	1,792	8th April 1925.	Do.
Do. .	(136) Mg. Choon .	Tin and allied minerals.	P. L. .	1,157·12	17th September 1925.	Do.
Do. .	(137) Mr. Jas McGregor.	Tin . . .	P. L. .	1,190·4	12th February 1925.	Do.
Do. .	(138) Mr Md. Haniff	Tin ore and other allied metals.	P. L. .	1,843·2	23rd February 1925.	Do.
Do. .	(139) Ma Kyon .	Tin . . .	P. L. .	163·84	15th January 1925.	Do.
Do. .	(140) Mr. Joo Seng .	All minerals except oil.	P. L. .	985·6	1st August 1925.	Do.
Do. .	(141) Do. .	Do. .	P. L. .	563·2	22nd April 1925.	Do.
Do. .	(142) Do. .	Do. .	P. L .	568·3	Do.	Do.
Do. .	(143) Mr. Khaw Joo Tok.	Tin and allied minerals.	P. L. .	1,280	2nd April 1925.	Do.
Do. .	(144) Dr. San Moe .	Do. .	P. L. .	161·3	28th March 1925.	Do.
Do. .	(145) Mr. A. S. Mohamed.	Tin . . .	P. L. .	778·2	26th March 1925.	Do.
Do. .	(146) Maung Choon .	Tin and allied minerals.	P. L. .	691·2	4th August 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

* Sanctioned on 23rd December 1925.

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant	Area in acres.	Date of commencement.	Term.
Mergui .	(147) Maung San Dun.	Tin and allied minerals.	P. L. .	189·4	4th April 1925.	1 year.
Do.	(148) Mr. A. Herbert Noyes.	Tin ore and allied metals.	P. L. .	117·8	31st July 1925.	Do.
Do. .	(149) Mr. E. Ahmed .	Tin ore . .	P. L. .	192	20th March 1925.	Do.
Do. .	(150) Maung Po .	Tin . . .	P. L. .	240 6	18th May 1925.	Do.
Do. .	(151) Mr. H. Kim Choo	Tin and allied minerals.	P. L. .	622·7	20th April 1925.	Do.
Do. .	(152) Mr. S. Warwick Smith	All minerals except mineral oil.	P. L. .	716·8	25th September 1925.	Do.
Do. .	(153) Mr. P. B. O. Watson.	Tin and allied minerals.	P. L. .	1,047	17th September 1925.	Do.
Do. .	(154) Tan Po Chit .	All minerals except oil	P L. .	286·7	9th September 1925.	Do.
Do. .	(155) Yeo Sain Guan	Tin and allied minerals.	P. L. .	590	18th August 1925.	Do.
Do. .	(156) Leong Foke Hye	Do. .	P. L. .	460·8	2nd June 1925.	Do.
Do. .	(157) Ma Kyon .	Tin . . .	P. L. .	353·3	20th May 1925.	Do.
Do. .	(158) Mr. Joo Seng .	All minerals except oil.	P. L. .	640	17th September 1925.	Do.
Do. .	(159) Mr. E. B. Milne.	Do. .	P. L. .	1,267·2	26th September 1925.	Do.
Do. .	(160) Leong Foke Hye.	Tin and allied metals.	P. L. .	747·5	5th September 1925.	Do.
Do. .	(161) Lee Quee Chee .	Do. .	P. L. .	629·8	20th March 1925.	Do.
Do. .	(162) Do .	Do. .	P. L. .	1,843·2	22nd August 1925.	Do.
Do. .	(163) Do. .	Do. .	P. L. .	573·4	20th May 1925.	Do.
Do. .	(164) Do. .	Do. .	P. L. .	921·6	22nd August 1925.	Do.
Do. .	(165) Do. .	Do. .	P. L. .	215	20th May 1925.	Do.
Do.	(166) Ma Kyon .	Tin . . .	P. L. .	624	30th July 1925.	Do.
Do. .	(167) Mg. Kyin Bu .	Tin and allied metals.	P. L. .	87	19th October 1925.	Do.
Do. .	(168) Maung San Dun	Tin . . .	P. L. .	128	3rd August 1925.	Do.
Do. .	(169) Mr. A. Herbert Noyes	Cassiterite and allied minerals.	P. L. .	657·0	8th September 1925.	Do.

P. L. = Prospecting License. M. L. = Mining Lease.

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Mergui .	(170) Mr. Joo Seng .	Tin and allied minerals.	P. L. .	122·9	1st August 1925.	1 year.
Do. .	(171) L. Ah Foo .	Tin and allied metals.	P. L. .	622·7	21st October 1925.	Do.
Do. .	(172) Mr. S. Warwick Smith.	All minerals except mineral oil.	P. L. .	194·6	17th September 1925.	Do.
Do. .	(173) Mr. A. E. Ahmad	Tin ore and other allied metals.	P. L. .	325·1	5th November 1925.	Do.
Do. .	(174) Messrs. Mayan Chaung Alluvials, Ltd.	Tin and allied minerals	P. L. .	389·1	26th October 1925.	Do.
Do. .	(175) Mr. Khaw Joo Tok.	Do. .	P. L. .	463·4	17th August 1925.	Do.
Do. .	(176) Mr. Geo. W. Bowden.	Tin ore and wolfram.	P. L. .	629·8	4th April 1925.	Do.
Do. .	(177) Mr. Joo Seng .	Tin ore . .	P. L. .	51·2	21st October 1925.	Do.
Do. .	(178) Do. .	Tin . . .	P. L. .	220·2	19th October 1925.	Do.
Do. .	(179) Leong Ah Foo .	Tin and allied minerals.	P. L. .	542·7	21st October 1925.	Do.
Do. .	(180) Mr. A. Aziz Yunose.	Tin . . .	P. L. .	552·96	5th November 1925.	Do.
Do. .	(181) Mohamed Ghose	All minerals except mineral oil.	P. L. .	337·92	8th December 1925.	Do.
Do. .	(182) Joo Seng . .	Do. .	P. L. .	3,230·72	*	Do.
Do. .	(183) Mr. A. S. Mahomed.	Tin ore . .	M. L. .	384	10th July 1925.	15 years.
Do. .	(184) Ma Kyin Mya and Ma Lin.	Tin and allied minerals except natural petroleum.	M. L. .	296·32	24th October 1924.	30 years.
Do. .	(185) In Sit Yan .	Tin and other minerals.	P. L. . (renewal).	235·52	17th January 1925.	1 year.
Do. .	(186) Mr. J. I. Milne .	All minerals except mineral oil.	P. L. . (renewal).	1,441·28	11th January 1925.	2 years.
Do. .	(187) Mr. Chan Khain Look.	Do. .	P. L. . (renewal).	860·16	22nd February 1925.	1 year.
Do. .	(188) Maung Po Thaik and 2.	Tin . . .	P. L. . (renewal).	1,971·2	24th April 1925.	Do.
Do. .	(189) Tan Po Chit .	All minerals except oil.	P. L. . (renewal).	614·4	30th July 1925.	Do.
Do. .	(190) In Sit Yan .	Tin and other minerals.	P. L. . (renewal).	624·64	6th August 1925.	Do.
Do. .	(191) Mr. C. Chan Shwe.	All minerals except mineral oil.	P. L. . (renewal).	1,484·8	21st July 1925.	2 years.

P. L. = *Prospecting License*. *M. L.* = *Mining Lease*.
* Sanctioned on 17th November 1925.

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Meigul .	(192) Mr. J. I. Milne .	All minerals except mineral oil.	P. L. . (renewal).	634·88	23rd July 1925.	2 years.
Do. .	(193) Mr. Joo Seng .	All minerals except oil.	P. L. . (renewal).	471·04	10th September 1925.	1 year.
Do. .	(194) Mr. A. E. Ahmed	Tin ore . .	P. L. . (renewal).	558·08	Do.	Do.
Do. .	(195) Mr. E. Ahmed .	Do. .	P. L. . (renewal).	1,000·96	2nd October 1925.	Do.
Do. .	(196) Messrs. Beadon and Doupe.	Tin and other minerals except mineral oil.	P. L. . (renewal).	2,329·6	19th November 1925.	Do.
Do. .	(197) Mr. Md. Haniff	Tin . . .	P. L. . (renewal).	1,336·32	24th November 1925.	Do.
Minbu .	(198) Messrs. Burma Finance and Mining Co.	All kinds of minerals including natural petroleum.	P. L. .	352·64	3rd November 1925.	Do.
Do. .	(199) Messrs. Burmah Oil Co., Ltd.	Natural petroleum.	P. L. . (renewal).	640	23rd January 1925.	Do.
Do. .	(200) Indo-Burma Petroleum Co., Ltd.	Do. .	P. L. . (renewal).	1,926·4	5th January 1925.	Do.
Do. .	(201) D. M. Akhoon .	Do. .	P. L. . (renewal).	1,280	18th May 1925.	Do.
Myingyan .	(202) Burmah Oil Co., Ltd.	Do. .	P. L. .	1,920	10th June 1925.	2 years.
Do. .	(203) Do. .	Do. .	P. L. .	1,036·8	25th March 1925.	Do.
Do. .	(204) Do. .	Do. .	P. L. . (renewal).	2,960	5th July 1925.	1 year.
Do. .	(205) Do. .	Do. .	P. L. . (renewal).	1,760	7th May 1925.	Do.
Do. .	(206) Do. .	Do. .	P. L. . (renewal).	1,004·8	31st July 1925.	Do.
Do. .	(207) Do. .	Do. .	P. L. . (renewal).	1,440	10th June 1925.	Do.
Do. .	(208) Maung Net & 1	Do. .	P. L. . (renewal).	99·84	3rd November 1925.	Do.
Do. .	(209) Burmah Oil Co., Ltd.	Do. .	P. L. . (renewal).	2,913·44	22nd December 1925.	Do.
Do. .	(210) Do. .	Do. .	P. L. . (renewal).	1,580·16	20th December 1925.	Do.
Do. .	(211) Do. .	Do. .	P. L. . (renewal).	1,158·4	17th September 1925.	Do.
Do. .	(212) Do. .	Do. .	P. L. . (renewal).	40·96	20th December 1924.	Do.
Do. .	(213) Do. .	Do. .	P. L. . (renewal).	2,812·44	22nd December 1924.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral	Nature of grant.	Area in acres.	Date of commencement.	Term.
Myitkyina .	(214) Mr. C. W. Chater.	All minerals except oil.	P. L. . (renewal).	8·32	13th October 1924.	1 year.
Northern Shan States.	(215) Maung Khin Maung Momeik Sawbwa.	All kinds of minerals and precious stones.	P. L. .	274·56	1st September 1925.	Do.
Do. .	(216) Burma Corporation Ltd., Namtu.	Iron ore . .	M. L. .	79·36	22nd August 1925.	30 years.
Do. .	(217) Do. .	Do. .	M. L. .	268·8	22nd August 1925.	Do.
Pakokku .	(218) Indo-Burma Petroleum Co., Ltd.	Natural petroleum.	P. L. .	723·2	*	2 years.
Do. .	(219) Burmah Oil Co., Ltd.	Do. .	P. L. .	13,440	†	Do.
Do. .	(220) Nath Sing Oil Co., Ltd.	Do. .	P. L. .	4,089·6	‡	Do.
Do. .	(221) Messrs. E. Solomon & Son.	Do .	M. L. .	2,560	10th February 1925.	30 years.
Do. .	(222) Burmah Oil Co., Ltd.	Do. .	P. L. . (renewal).	800	7th November 1924.	1 year.
Do. .	(223) Mr. Colin Campbell.	Do. .	P. L. . (renewal).	551·24	22nd November 1924.	Do.
Do. .	(224) Ma Zan . .	Do. .	P. L. . (renewal).	99·84	20th June 1925.	Do.
Shwebo .	(225) Indo-Burma Petroleum Co., Ltd.	Do .	P. L. .	6,080	12th March 1925.	Do.
Do. .	(226) Burmah Oil Co., Ltd.	Do. .	P. L. .	4,704	23rd November 1925.	2 years.
Do. .	(227) Indo-Burma Petroleum Co., Ltd.	Do. .	P. L. .	5,113·6	§	1 year.
Do. .	(228) Burmah Oil Co., Ltd.	Do. .	P. L. . (renewal).	2,336	25th September 1924.	Do.
Do. .	(229) Do. .	Do. .	P. L. . (renewal).	2,310·4	Do.	
Do. .	(230) Indo-Burma Petroleum Co., Ltd.	Do. .	P. L. . (renewal).	5,440	14th August 1925.	Do.
Southern Shan States.	(231) J. W. Ryan .	All minerals except oil.	P. L. .	512	June 1925 .	Do.
Do. .	(232) C. F. Browne .	Do.. .	P. L. .	640	18th August 1925.	Do.
Do. .	(233) Kalaw Mining Syndicate.	Do. .	P. L. .	3,200	27th July 1925.	Do.
Do. .	(234) Steel Bros. & Co., Ltd.	Do. .	P. L. .	2,240	25th July 1925.	Do.
Do. .	(235) Colin Campbell	Do. .	P. L. .	1,920	19th November 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*
* Sanctioned on 23rd October 1924. † Sanctioned on 23rd December 1925.
‡ Sanctioned on 26th August 1925. § Sanctioned on 19th January 1925.

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Southern Shan States.	(236) Captain C. R. Smith.	All minerals except oil.	P. L.	3,200	25th September 1925.	1 year.
Do.	(237) Colin Campbell	Do.	P. L.	896	28th November 1925.	Do.
Do.	(238) Steel Bros. & Co., Ltd.	Do.	P. L. (renewal.)	1,574·4	1st June 1925.	2 years.
Do.	(239) Colin Campbell	Do.	P. L. (renewal.)	2,880	18th December 1925.	1 year.
Tavoy	(240) Ong Hoe Kyin	Tin and wolfram	P. L.	217·6	15th January 1925.	Do.
Do.	(241) Mr. B. Ribbentrop.	Do.	P. L.	640	21st January 1925.	Do.
Do.	(242) Tavoy Tin Dredging Corpn., Ltd.	Tin	P. L.	300·8	2nd May 1925	Do.
Do.	(243) Do.	Do.	P. L.	179·2	25th August 1925.	6 months.
Do.	(244) Mr. James M. Watt.	Tin and wolfram	P. L.	640	20th February 1925.	1 year.
Do.	(245) Burma Finance and Mining Co., Ltd.	Do.	P. L.	1,280	21st March 1925.	Do.
Do.	(246) Tavoy Tin Dredging Corpn., Ltd.	Tin	P. L.	1,177 6	28th May 1925	Do.
Do.	(247) Mr. M. A. Musaji	Tin and wolfram	P. L.	320	13th February 1925.	Do.
Do.	(248) Mr. Mamode Assenjee.	Do.	P. L.	396·8	15th June 1925.	6 months.
Do.	(249) Mr. J. W. Newbery.	Do.	P. L.	1,068 8	18th June 1925.	1 year.
Do.	(250) Ong Hoe Kyin	Do.	P. L.	198·4	10th July 1925.	Do.
Do.	(251) Mr. Wong Cheuk	Do.	P. L.	640	23rd July 1925.	Do.
Do.	(252) Ma Yai	Do.	P. L.	300·8	7th September 1925.	Do.
Do.	(253) San Chit Swe	Do.	P. L.	614·4	29th June 1925.	Do.
Do.	(254) Ma Yi	Do.	P. L.	640	17th August 1925.	Do.
Do.	(255) Mr. J. W. Watt	Do.	P. L.	422·4	19th October 1925.	Do.
Do.	(256) Maung Ba Bwa	Do.	P. L.	640	13th August 1925.	Do.
Do.	(257) Mr. J. T. Doupe	Do.	P. L.	192	16th October 1925.	Do.
Do.	(258) Maung Ngwe Thi	Do.	P. L.	563·2	Do.	Do.

P. L. = *Prospecting Licence.* *M. L.* = *Mining Lease.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Tavoy .	(259) Ma Thein May .	Tin and wolfram	P. L. .	640	18th September 1925.	6 months.
Do. .	(260) Mrs. S. Wellington.	Do. .	P. L. .	89·6	21st September 1925.	1 year.
Do. .	(261) Maung Ngwe Thi	Do. .	P. L. .	640	17th September 1925.	Do.
Do. .	(262) Mr. J. W. Newbery.	Do. .	P. L. .	422·4	10th November 1925.	Do.
Do. .	(263) Mr. B. Ribbentrop.	Do. .	P. L. .	640	1st September 1925.	Do.
Do. .	(264) Mr. H. Kim Chu	Do. .	P. L. .	435·2	30th November 1925.	Do.
Do. .	(265) Finance Mining Co., Ltd.	Do. .	P. L. .	288	10th October 1925.	Do.
Do. .	(266) Mr. M. A. Musaji	Do. .	P. L. .	409 6	30th November 1925,	6 months.
Do. .	(267) Mr. H. Kim Chu	Do. .	P. L. .	396·8	Do.	1 year.
Do. .	(268) Mrs. S. Wellington.	Do. .	P. L. .	384	2nd December 1925.	Do.
Do. .	(269) Ung Cheng Hong	Do. .	P. L. .	844·8	19th December 1925.	Do.
Do. .	(270) Mr. Ali Adjim Sooratee.	Do. .	P. L. .	537·6	21st October 1925.	Do.
Do. .	(271) Mr. W. C. Toms	Do. .	P. L. .	569 6	5th December 1925.	Do.
Do. .	(272) Mr. Ali Adjim Sooratee.	Do. .	P. L. .	352	19th December 1925.	Do.
Do. .	(273) The Burma Finance and Mining Co., Ltd.	Do. .	M. L. .	1,762·56	25th July 1925.	30 years.
Do. .	(274) Mr. J. J. A. Page	Cassiterite, wolframite and gold.	M. L. .	179 84	30th March 1925.	Do.
Do. .	(275) Do. .	Cassiterite . .	M. L. .	99 84	31st March 1925.	10 years.
Do. .	(276) Maung Ni Toe .	Wolfram and tin	M. L. .	179·2	17th November 1925.	25 years.
Do. .	(277) Do. .	Do. .	M. L. .	155 84	5th May 1925	30 years.
Do. .	(278) U. Maung Maung	Do. .	M. L. .	640	7th September 1925.	Do.
Do. .	(279) Messrs. The Tavoy Tin Dredging Corpn., Ltd.	Tin . . .	M. L. .	144	4th Septem ber 1925.	Do.
Do. .	(280) Mr. Lee Talk Seong.	Wolfram and tin	M. L. .	293·12	9th January 1925.	Do.
Do. .	(281) Messrs. The Burma Finance and Mining Co., Ltd.	Do. .	M. L. .	217·6	11th August 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

BURMA—*contd.*

District.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Tavoy .	(282) Mr. A. W. Ross.	Wolfram and tin	P. L. (renewal.)	1216	21st February 1925.	1 year.
Do. .	(283) Mr. J. T. Doupe	All minerals except oil.	P. L. (renewal)	1,433·6	12th January 1925.	Do.
Do. .	(284) Burma Finance and Mining Co., Ltd., formerly Mr. M. T. Dunstan.	Tin and wolfram	P. L. (renewal.)	499·2	2nd January 1925.	Do.
Do. .	(285) Do. .	Do. .	P. L. (renewal.)	192	Do. .	Do.
Do. .	(286) Quah Cheng Guan.	All minerals except oil.	P. L. (renewal.)	729·6	Do. .	Do.
Do. .	(287) Do. .	Do. .	P. L. (renewal.)	582·4	Do. .	Do.
Do. .	(288) Mr. W. C. Toms	Tin and allied metals.	P. L. (renewal.)	633·6	3rd March 1925.	Do.
Do. .	(289) Mr. T. J. Mackoy	Tin and wolfram	P. L. (renewal.)	492·8	8th March 1925.	Do.
Do. .	(290) Mr. H. Kim Chu	Tin and allied minerals.	P. L. (renewal.)	102	25th March 1925.	Do.
Do. .	(291) Maung Ni Toe .	All minerals except oil.	P. L. (renewal.)	96	20th March 1925.	Do.
Do. .	(292) Quah Cheng Tock	Do. .	P. L. (renewal.)	864	12th June 1925.	Do.
Do. .	(293) Quah Cheng Guan.	Do. .	P. L. (renewal.)	256	24th June 1925.	Do.
Do. .	(294) U. Maung Maung	Tin and wolfram	P. L. (renewal.)	473·6	25th June 1925.	Do.
Do. .	(295) Mr. W. C. Toms	All minerals except oil.	P. L. (renewal)	633·6	10th July 1925.	Do.
Do. .	(296) Mr. H. Kelly .	Tin and other minerals.	P. L. (renewal.)	396·8	24th July 1925.	Do.
Do. .	(297) U. Maung Maung	Tin and wolfram	P. L. (renewal.)	320	15th September 1925.	Do.
Do. .	(298) Mr. A. W. Ross	Tin . . .	P. L. (renewal.)	160	6th October 1925.	6 months.
Do. .	(299) Ma Yal . .	Tin and wolfram	P. L. (renewal.)	640	8th November 1925.	1 year.
Thaton .	(300) Mr. B. R. Fernandez.	All minerals except oil.	P. L. .	247·68	29th May 1925.	Do.
Do. .	(301) Maung Po .	Do. .	P. L. .	480	22nd June 1925.	Do.
Do. .	(302) Mr. A. Rahim .	Do. .	P. L. .	2,456	21st October 1925.	Do.
Thayetmyo .	(303) Messrs. Indo-Burma Petroleum Co., Ltd.	Natural petroleum	P. L. .	8,960	9th February 1925.	2 years.
Do. .	(304) Messrs. Indo-Burma Oilfields, Ltd.	Do. .	P. L.	633·6	2nd January 1925.	1 year.

P. L. = *Prospecting License* *M. L.* = *Mining Lease.*

BURMA—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Thayetmyo.	(305) Messrs. Burmah Oil Co., Ltd.	Natural petroleum	P. L.	1,280	6th August 1925.	2 years.
Do.	(306) U. Shwe Ni, Agent of Chwa Maung Pike.	Chromite	P. L.	2,444·8	31st July 1925.	1 year.
Do.	(307) C. M. Jeewajee, Allanmyo.	Natural petroleum	P. L.	96	1st May 1925	2 years.
Do.	(308) Messrs. Indo-Burma Oilfields, Ltd.	Do.	P. L. (renewal)	960	12th March 1924.	1 year.
Do.	(309) Do.	Do.	P. L. (renewal.)	640	6th October 1924.	Do.
Do.	(310) Maung Hine Bu	Do.	P. L. (renewal.)	198·4	15th September 1924.	Do.
Do.	(311) Do.	Do.	P. L. (renewal.)	96	Do.	Do.
Do.	(312) Chwa Maung Pike.	Do.	P. L. (renewal.)	96	12th October 1924.	Do.
Do.	(313) Mr. Rowland Ady.	Do.	P. L. (renewal.)	3,008	13th January 1925.	Do.
Do.	(314) Mr. Omer Abu Bucker *alias* Maung Ba Kyaw.	Do.	P. L. (renewal.)	2,560	23rd February 1925.	Do.
Do.	(315) Ismail Abu Ahmed.	Do.	P. L. (renewal.)	2,400	15th January 1925.	Do.
Do.	(316) Messrs. Indo-Burma Oilfields, Ltd.	Do.	P. L. (renewal.)	960	12th March 1925.	Do.
Do.	(317) Mr. Colin Campbell, Rangoon.	Do.	P. L. (renewal.)	1,420·8	11th July 1925.	Do.
Do.	(318) Messrs. Indo-Burma Oilfields, Ltd.	Do.	P. L. (renewal.)	2,560	12th July 1925.	Do.
Do.	(319) Chwa Maung Pike.	Do.	P. L. (renewal.)	96	12th October 1925.	Do.
Pungoo	(320) Capt. E. L. Bill	All minerals except oil.	P. L. (renewal.)	640	22nd February 1925.	Do.
Upper Chindwin.	(321) Messrs. The Indo-Burma Petroleum Co., Ltd.	Natural petroleum	P. L.	2,560	17th March 1925.	Do.
Do.	(322) Coalfields of Burma, Ltd.	Coal	P. L. (renewal.)	704	19th June 1925.	Do.
Do.	(323) The Indo-Burma Oilfields, Ltd.	Natural petroleum	P. L. (renewal.)	3,200	11th July 1925,	Do.
Do.	(324) The Burmah Oil Co., Ltd.	Do.	P. L. (renewal.)	1,760	28th August 1925.	Do.
Do.	(325) Indo-Burma Petroleum Co., Ltd.	Do.	P. L. (renewal.)	640	6th October 1925.	Do.
Yamethin	(326) Mr. A. C. Martin	All minerals except oil.	P. L.	1,555·2	24th October 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES.

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Balaghat .	(327) Rai Sahib L. Chhajuram.	Manganese . .	P. L. .	65	5th January 1925.	1 year.
Do. .	(329) Mr. Shamji Naranji.	Do. . .	P. L. .	8	6th January 1925.	Do.
Do. .	(329) Pandit Kripashankar.	Do. . .	P. L. .	451	1o.	Do.
Do. .	(330) Pandit Rewashankar.	Do. . .	M. L. .	131	1st September 1915.	30 years.
Do. .	(331) Messrs. M. B. Chopra.	Do. . .	M. L. .	17	27th March 1925.	5 years.
Do. .	(332) Messrs. B. P. Byramji and Company.	Do. . .	M. L. .	17	21st January 1925.	Do.
Do. .	(333) Pandit Kripashankar.	Do. . .	M. L. .	6	20th January 1925.	10 years.
Do. .	(334) Pandit Rewashankar.	Do. . .	P. L. .	28	24th February 1925.	1 year.
Do. .	(335) Messrs. Ramnagain and Seth Jagannath.	Do. . .	P. L. .	41b	30th June 1925.	Do.
Do. .	(336) Seth Chogmal Kocher.	Do. . .	M. L. .	126	19th March 1925.	30 years.
Do.	(337) Diwan Bahadur Seth Ballabhdas.	Do. . .	P. L. .	42	13th January 1925.	1 year.
Do. .	(338) Mr. Syed Minhajuddin Ahmed.	Do. . .	P. L. .	258	28th March 1925.	Do.
Do. .	(339) Rao Sahib L. Chhajuram.	Do. . .	P. L. .	210	2nd January 1925.	Do.
Do. .	(340) Messrs. B. P. Byramji and Company.	Do. . .	M. L. .	1	11th May 1925.	5 years.
Do. .	(341) Messrs. Tata Iron and Steel Company.	Do. . .	M. L. .	678	30th July 1924.	30 years.
Do. .	(342) Mr. Syed Minhajuddin Ahmed.	Do. . .	P. L. .	258	11th February 1925.	1 year.
Do. .	(343) Pandit Rewashankar.	Do. . .	M. L. .	30	21st July 1925.	15 years.
Do. .	(344) Messrs. B. Fouzdar Brothers.	Do. . .	P. L. .	25	28th March 1925.	1 year.
Do. .	(345) Messrs. Samrathmal Ratanchand.	Do. . .	P. L. .	60	22nd February 1925.	Do.
Do. .	(346) Messrs. Wasudeo Shrawanji.	Do. . .	P. L. .	16	30th January 1925.	Do.
Do. .	(347) Mr. P N. Oke .	Do. . .	P. L. .	23	3rd March 1925.	Do.
Do. .	(348) Messrs. B. P. Byramji and Company.	Do. . .	M. L. .	18	26th August 1924.	5 years.
Do. .	(349) Mr. Erachsha .	Do. . .	P. L. .	54	22nd May 1925.	1 year.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Balaghat .	(350) Mr. M. B. Marfatia.	Manganese . .	P. L. .	29	5th March 1925.	1 year.
Do. .	(351) Mr. Erachsha .	Do. . .	P. L. .	173	5th February 1925.	Do.
Do. .	(352) Seth Ganeshlal Balbhadra.	Do. . .	P. L. .	136	28th March 1925.	Do.
Do. .	(353) Do. .	Do. . .	P L. .	34	6th January 1925.	Do.
Do. .	(354) Seth Ganeshlal Ramchand.	Do. . .	P. L. .	41	Do.	Do.
Do. .	(355) Seth Shreeram .	Do. . .	M. L. .	22	17th March 1925.	15 years.
Do. .	(356) Messrs. Gupta & Sons.	Do. . .	P L. .	27	6th January 1925.	1 year.
Do. .	(357) Mr. Abdur Rahim Khan.	Do. .	P. L. .	5	11th February 1925.	Do
Do. .	(358) Messrs. N. D. Zal and Brothers.	Do . .	P. L. .	7	8th May 1925	Do.
Do. .	(359) Do. .	Do. .	P. L. .	15	8th May 1925	Do.
Do. .	(360) Mr. Abdur Rahim Khan.	Do. . .	M. L. .	38	3rd March 1925	30 years.
Do.	(361) Seth Protap Laxmiram.	Do. . .	P. L. .	162	16th January 1925.	1 year.
Do.	(362) Do. .	Do. .	P. L. .	38	Do.	Do.
Do. .	(363) Messrs. Gupta & Sons.	Do. . .	P. L. .	20	6th January 1925.	Do
Do. .	(364) Messrs. Samrathmal Ratanchand.	Do. . .	P. L.	43	3rd August 1925.	Do.
Do. .	(365) Mr. P. N. Oke .	Do. . .	P. L. .	161	22nd January 1925.	Do.
Do. .	(366) Messrs. Gupta & Sons.	Do. . .	P. L. .	64	13th March 1925.	1 year.
Do. .	(367) Messrs. Samrathmal Ratanchand.	Do. . .	P. L. .	112	20th July 1925.	Do.
Do. .	(368) Mr. Paramanand Dayaram.	Do. . .	P. L. .	12	16th January 1925.	Do.
Do. .	(369) Pandi Rewashankar.	Do. . .	M. L. .	19	9th June 1925.	10 years.
Do. .	(370) Sir M. B. Dadabhoy, Bar.-at-Law, Nagpur.	Do. . .	P. L. .	75	6th March 1925.	1 year.
Do. .	(371) Do. .	Do. . .	P. L.	528	Do. .	Do.
Do. .	(372) Do. .	Do. . .	P. L. .	11	Do. .	Do.
Do. .	(373) Do. .	Do. . .	P. L. .	7	6th March	Do.

P. L. = *Prospecting License*, *M. L.* = *Mining Lease*.

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Balaghat .	(374) Mr. Erachshah .	Manganese . .	P. L. .	32	5th February 1925.	1 year.
Do.	(375) Do.	Do. .	P. L. .	166	22nd May 1925.	Do.
Do. .	(376) Messrs. B. P. Byramji & Co.	Do. . .	M. L. .	4	21st January 1925.	5 years.
Do. .	(377) Do. .	Do. . .	M. L. .	2	Do. .	Do.
Do. .	(378) Do. .	Do. . .	M. L. .	18	28th October 1925.	Do.
Do. .	(379) Messrs. Abdul Hussain Mulla Allabuxji and Jamsetji Bilimoria.	Do. . .	P. L. .	115	3rd March 1925.	1 year.
Do. .	(380) Do. .	Do. . .	P. L. .	22	30th January 1925.	Do.
Do. .	(381) Mr. Permanand Dayaram.	Do. .	P. L.	46	7th March 1925.	Do.
Do. .	(382) Seth Shreeram .	Do. . .	M. L.	56	17th March 1925.	5 years.
Do. .	(383) Seth Ganeshlal Ramchand.	Do. . .	P. L.	3	28th March 1925.	1 year.
Do. .	(384) Seth Budharsao	Do. .	P. L. .	30	26th February 1925.	Do.
Do. .	(385) Mr. R. S. Sukhla	Do. . .	P. L.	10	Do. .	Do.
Do. .	(386) Seth Ganeshlal Ramchand.	Do. . .	P. L. .	84	28th March 1925.	Do.
Do. .	(387) Mr. Chandanlal	Do. . .	P. L. .	671	13th February 1925.	Do.
Do. .	(388) Mr. M. B. Mattia.	Do. . .	P. L. .	219	30th January 1925.	Do.
Do. .	(389) Messrs. Lal Behari Ramcharan.	Do. .	P. L. .	50	9th April 1925.	Do.
Do. .	(390) Do. .	Do. . .	P. L. .	50	Do. .	Do.
Do. .	(391) Mr. Parmanand Dayaram.	Do. . .	P. L. .	51	21st April 1925.	Do.
Do. .	(392) Do. .	Do. . .	P. L. .	92	16th February 1925.	Do.
Do. .	(393) Messrs. Punamchand Kishanlal.	Do. . .	P. L. .	493	24th February 1925.	Do.
Do. .	(394) Mr. Parmanand Dayaram.	Do. . .	P. L. .	16	14th May 1925.	Do.
Do. .	(395) R. S. Seth Gowardhan Dass.	Do. . .	P. L. .	171	26th February 1925.	Do.
Do. .	(396) Messrs. B. P. Byramji & Co.	Do. . .	P. L. .	80	22nd June 1925.	Do.

P. L. = *Prospecting License*, *M. L.* = *Mining Lease*.

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Balaghat .	(397) R. S. D Laxmi Narayan.	Manganese . .	P. L. .	267	24th February 1925.	1 year.
Do. .	(398) Seth Ganeshlal Ramchand.	Do. . .	P. L. .	23	28th March 1925.	Do.
Do. .	(399) Messrs. B. P. Byramji & Co.	Do. . .	M. L. .	22	21st January 1925.	4 years and 10 months
Do. .	(400) Sunderlal Golchha.	Do. . .	P. L. .	21	11th February 1925.	1 year.
Do. .	(401) Mr. M. B. Martatia.	Do. . .	P. L. .	129	5th March 1925.	Do.
Do. .	(402) Do. .	Do. . .	P. L. .	196	30th January 1925.	Do.
Do. .	(403) Mr. P. N. Oke .	Do. . .	P. L. .	17	9th May 1925	Do.
Do. .	(404) Seth Budharsao	Do. . .	P. L. .	123	3rd March 1925.	Do.
Do. .	(405) Messrs. Martin & Co.	Do. . .	P. L. .	27	22nd June 1925.	Do.
Do. .	(406) Do. .	Do. . .	P. L. .	76	Do. .	Do.
Do. .	(407) Messrs. Samrathmal Ratanchand.	Do. . .	P. L. .	101	20th July 1 25	Do.
Do. .	(408) Seth Budharsao	Do. . .	P. L. .	311	14th September 1925.	Do.
Do. .	(409) Seth Chunnilal Sao.	Do. . .	P. L. .	13	24th February 1925.	Do.
Do. .	(410) Mr. Sunderlal Golchha.	Do. . .	P. L. .	113	5th May 1925	Do.
Do. .	(411) The Netra Manganese Company, Ltd.	Do. . .	P. L. .	12	4th July 1925	Do.
Do. .	(412) Mr. Chandanlal	Do. . .	P. L. .	267	22nd February 1925.	Do.
Do. .	(413) Mr. M. B. Marfatia.	Do. . .	P. L. .	166	8th February 1925.	Do.
Do. .	(414) Mr. P. N. Oke .	Do. . .	P. L. .	48	24th February 1925.	Do.
Do. .	(415) Do. .	Do. . .	P. L. .	17	9th May 1925	Do.
Do. .	(416) Mr. Ganpat Rao Laxman Rao.	Do. . .	P. L. .	296	3rd August 1925.	Do.
Do. .	(417) Mr. C. S. Harris	Do. . .	P. L. .	46	1st April 1925.	Do.
Do. .	(418) Messrs. Cheniram Jeeraj.	Do. . .	P. L. .	32	25th May 1925.	Do.
Do. .	(419) Seth Chunilal Sao.	Do. . .	P. L. .	791	11th February 1925.	Do.
Do. .	(420) Messrs. Nosherwanji and Ardeshir.	Do. . .	P. L. .	90	25th May 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Balaghat .	(421) Pandit Rewashankar.	Manganese .	P. L. .	18	14th May 1925.	1 year.
Do. .	(422) Rai Sahib A. P. Bhargawa.	Do. . .	P. L. .	176	30th March 1925.	Do.
Do. .	(423) Mr. M. B. Marfatla.	Do. . .	P. L. .	106	9th April 1925.	Do.
Do. .	(424) Pandit Rewashankar.	Do. . .	P. L. .	240	20th July 1925.	Do.
Do. .	(425) Messrs. Nosherwanji and Ardeshi Brothers.	Do. . .	P. L. .	174	25th May 1925.	Do.
Do. .	(426) Mr. S. R. Pandit	Do. . .	P. L. .	811	21st April 1925.	Do.
Do. .	(427) Mr. P. N. Oke .	Do. . .	M. L. .	42	23rd May 1925.	30 years.
Do. .	(428) Mr. Samiulla Khan.	Do. . .	P. L. .	63	8th May 1925	1 year.
Do. .	(429) Mr. C. S. Harris	Do. . .	P. L. .	26	1st April 1925.	Do.
Do. .	(430) Messrs. B. P. Byramji & Co.	Do. . .	M. L. .	29	24th January 1925.	5 years.
Do. .	(431) Mr. P. N. Oke .	Do. . .	M. L. .	19	23rd May 1925.	30 years.
Do. .	(432) Seth Chunnilal Sao.	Do. . .	P. L. .	25	8th May 1925	1 year.
Do. .	(433) Seth Budharsao	Do. . .	P. L. .	310	28th October 1925.	Do.
Do. .	(434) Messrs. B. P. Byramji & Co.	Do. . .	P. L. .	161	15th April 1925.	Do.
Do. .	(435) Mr. Abdul Rahim Khan.	Do. . .	P. L. .	8	11th February 1925.	Do.
Do. .	(436) Do. .	Do. . .	P. L. .	6	6th March 1925.	Do.
Do. .	(437) Rao Sahib Seth Gowardhan Das.	Do. . .	M. L. .	3	21st September 1925.	10 years.
Do. .	(438) Mr. Shamji Narayanji.	Do. . .	M. L. .	8	5th October 1925.	5 years.
Do. .	(439) Mr. Shamji Narayanji.	Do. . .	M. L. .	7	5th October 1925.	5 years.
Do. .	(440) Messrs. Nourojee Rustamjee and M. Chakrabarty.	Do. . .	P. L. .	38	30th August 1925.	1 year.
Do. .	(441) Messrs. Cheniram Jesraj.	Do. . .	P. L. .	354	3rd April 1925	Do.
Do. .	(442) Messrs. Ganpatsao Dhanpatsao	Do. . .	P. L. .	37	8th October 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Balaghat .	(443) Seth Shreeram .	Manganese .	M. L. .	10	4th July 1925	Will expire with the mining lease dated the 30th Mar. 1922, to which it is supplementary.
Do.	(444) Messrs. Ganpatsao Dhanpatsao.	Do. . .	P. L. .	225	8th October 1925.	1 year.
Do. .	(445) Thakur Nasib Singh.	Do. . .	P. L. .	104	18th June 1925.	Do.
Do. .	(446) Mr. Samiulla Khan.	Do. . .	P. L. .	79	8th April 1925.	Do.
Do. .	(447) Pandit Kripashankar.	Do. . .	P. L. .	65	8th October 1925.	Do.
Do. .	(448) Rai Sahib Seth Gowardhan Das.	Do. . .	M. L. .	20	9th July 1925.	10 years.
Do. .	(449) Rai Sahib A. P. Bhargava.	Do. . .	M. L. .	103	28th May 1925.	30 years.
Do. .	(450) Do. .	Do. . .	M. L. .	100	Do.	Do.
Do. .	(451) Pandit Rewashankar.	Do. . .	P. L. .	72	11th May 1925.	1 year.
Do. .	(452) Do. .	Do. . .	P. L. .	11	Do.	Do.
Do. .	(453) Mr. Chandanlal .	Do. . .	P. L. .	8	15th April 1925.	Do.
Do. .	(454) Seth Balbhadrasao.	Do. . .	P. L. .	231	5th May 1925	Do.
Do. .	(455) Mr. M. B. Marfatia.	Do, .	P. L. .	16	6th April 1925	Do.
Do. .	(456) Do. .	Do. . .	P. L. .	173	12th October 1925.	Do.
Do. .	(457) Pandit Kripashankar.	Do. . .	P. L. .	67	25th May 1925.	Do.
Do. .	(458) Messrs. B. P. Byramji & Co.	Do. . .	M. L. .	11	23rd February 1925.	5 years.
Do. .	(459) Mr. M. B. Marfatia.	Do. . .	P. L. .	35	28th March 1925.	1 year.
Do. .	(460) Pandit Kripashankar.	Do. . .	P. L. .	256	22nd June 1925.	Do.
Do. .	(461) Seth Budhar Sao	Do. . .	P. L. .	73	18th July 1925.	Do.
Do. .	(462) The Netra Manganese Co., Ltd.	Do. . .	M. L. .	69	2nd October 1925.	30 years.
Do. .	(463) Messrs. Nosherwanji Ardeshir Brothers.	Do. . .	P. L. .	10	25th August 1925.	1 year.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Balaghat .	(464) Thakur Nasib Singh.	Manganese . .	P. L. .	24	18th June 1925.	1 year.
Do. .	(465) Dr. B. D. Vyas .	Do. . .	P. L. .	31	5th May 1925	Do.
Do. .	(466) Do. .	Do. . .	P. L. .	6	Do.	Do.
Do. .	(467) Seth Mishrilal Meghraj.	Do. . .	P. L. .	65	22nd May 1925.	Do.
Do. .	(468) Pandit Rewashankar.	Do. . .	P. L. .	6	20th July 1925.	Do.
Do. .	(469) Messrs. Cheniram Jesraj.	Do. . .	P. L. .	61	17th August 1925.	Do.
Do. .	(470) Mr. M. B. Marfatia.	Do. . .	P. L. .	49	18th July 1925.	Do.
Do. .	(471) Mr. Samiulla Khan.	Do. . .	P. L. .	488	25th August 1925.	Do.
Do. .	(472) Seth Ganeshlal and Seth Balbhadra.	Do. . .	P. L. .	31	30th June 1925.	Do.
Do. .	(473) Mr. Chandanlal .	Do. . .	P. L. .	180	Do.	Do.
Do. .	(474) Do. .	Do. . .	P. L. .	39	26th June 1925.	Do.
Do. .	(475) Mr. Abdur Rahim Khan.	Do. . .	P. L. .	56	22nd December 1925.	Do.
Do. .	(476) Do. .	Do. .	P. L. .	30	Do.	Do.
Do. .	(477) Mr. M. B. Marfatia.	Do. .	P. L. .	79	30th June 1925.	Do.
Do.	(478) Mr. Mohomed Anwar Pasha, Minor guardian Munshi S. Allimuddin.	Do. . .	P. L. .	106	30th October 1925.	Do.
Do.	(479) Mr. Samiulla Khan.	Do. . .	P. L. .	75	18th September 1925.	Do.
Do. .	(480) Pandit Kripashankar.	Do. . .	P. L. .	57	11th July 1925.	Do.
Do. .	(481) Mr. M. B. Marfatia.	Do. . .	P. L. .	75	10th August 1925.	Do.
Do. .	(482) Do. .	Do. . .	P. L. .	94	28th September 1925.	Do.
Do. .	(483) Do. .	Do. . .	P. L. .	57	9th August 1925.	Do.
Do. .	(484) Syed Minhajuddin Ahmed.	Do. . .	P. L. .	7	11th December 1925.	Do.
Do. .	(485) Mr. Samiulla Khan.	Do. . .	P. L. .	25	15th October 1925.	Do.
Do. .	(486) Messrs. Bhagwandeen and M. A. Razaque.	Do. . .	P. L. .	50	10th August 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Balaghat .	(487) Mr. C. S. Harris	Manganese . .	M. L. .	67	11th September 1925.	30 years.
Do. .	(488) Messrs. Martin & Co.	Do. . .	P. L. .	12	11th December 1925.	1 year.
Do. .	(489) Pandit Rewashankar.	Do. . .	P. L. .	69	28th October 1925.	Do.
Do. .	(490) Mr. M. B. Marfatia.	Do. .	P. L. .	183	28th September 1925.	Do.
Do. .	(491) Mr. Samiulla Khan.	Do. . .	P. L. .	2	18th September 1925.	Do.
Do. .	(492) Do. .	Do. . .	P. L. .	59	15th October 1925.	Do.
Do. .	(493) Do. .	Do. . .	P. L. .	63	25th August 1925.	Do.
Do. .	(494) Thakur Nasib Singh.	Do. . .	P. L. .	170	Do.	Do.
Do. .	(495) Seth Bhudharsao.	Do. . .	P. .	401	Do.	Do.
Do. .	(49) Do. .	Do. . .	P. L. .	18	10th August 1925.	Do.
Do. .	(497) Do. .	Do. . .	P. L. .	43	30th August 1925.	Do.
Do. .	(498) Messrs. Nosherwanji and Ardeshir Brothers.	Do. . .	P. L. .	25	25th August 1925.	Do.
Do. .	(499) Mr. P. N. Oke .	Do. . .	P. L. .	17	Do.	Do.
Do. .	(500) Mr. M. B. Marfatia.	Do. . .	P. L. .	22	28th August 1925.	Do.
Do. .	(501) Pandit Kripashankar.	Do. . .	P. L. .	107	Do.	Do.
Do. .	(502) Mr. Syed Minhajuddin Ahmed.	Do. . .	M. L. .	4	30th November 1925.	30 years.
Do. .	(503) Mr. G. E. Muller	Do. . .	M. L. .	94	5th October 1925.	5 years.
Do. .	(504) Thakur Nasib Singh.	Do. . .	P. L. .	346	16th September 1925.	1 year.
Do. .	(505) Mr. Ganpatsao Dhanpatsao.	Do. . .	P. L. .	1	13th November 1925.	Do.
Do. .	(506) Thakur Nasib Singh.	Do. . .	P. L. .	236	16th September 1925.	Do.
Do. .	(507) Mr. C. Stanley Harris.	Do. . .	M. L. .	30	19th November 1925.	30 years.
Do. .	(508) Mr. Samiulla Khan.	Do. . .	P. L. .	67	20th December 1925.	1 year.
Do. .	(509) Seth Budharsao	Do. . .	P. L. .	41	10th August 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Balaghat .	(510) Mr. M. B. Marfatia.	Manganese .	P. L. .	100	9th December 1925.	1 year.
Do. .	(511) Mr. C. S. Harris	Do. . .	P. L. .	41	18th September 1925.	Do.
Do. .	(512) Seth Chunilal Sao.	Do. . .	P. L. .	53	13th November 1925.	Do.
Do. .	(513) Mr. M. B. Marfatia.	Do. . .	P. L. .	78	28th October 1925.	Do.
Do. .	(514) Messrs. Nilkant Sao & Co.	Do. . .	P. L. .	44	15th October 1925.	Do.
Do. .	(515) Pandit Kripashankar.	Do. . .	P. L. .	38	5th November 1925.	Do.
Do. .	(516) Messrs. Nilkant Sao & Co.	Do. . .	P. L. .	148	31st October 1925.	Do.
Do. .	(517) Pandit Kripashankar.	Do. . .	P. L. .	57	8th October 1925.	Do.
Do. .	(518) Rai Sahib L. Chhojuram.	Do. . .	P. L. .	6	19th December 1925.	Do.
Do. .	(519) Messrs. Chhotan and Premlal.	Do. . .	P. L. .	27	10th November 1925.	Do.
Do. .	(520) Messrs. Gupta & Sons.	Do. . .	P. L. .	13	26th November 1925.	Do.
Do. .	(521) Mr. Samiulla Khan.	Do . .	P. L. .	112	20th December 1925.	Do.
Do. .	(522) Do. .	Do. . .	P. L. .	6	Do.	Do.
Do. .	(523) Messrs. Nilkant Sao & Co.	Do. . .	P. L. .	2	21st October 1925.	Do.
Do. .	(524) Messrs. Ramnath Baijnath Rusia.	Do. . .	P. L. .	18	22nd November 1925.	Do.
Do. .	(525) Do. .	Do. . .	P. L. .	176	Do.	Do.
Do. .	(526) Seth Parmanand Bansidhar.	Do. . .	P. L. .	8	26th November 1925.	Do.
Do. .	(527) Messrs. Ganpatsao Dhanpatsao.	Do. . .	P. L. .	12	11th December 1925.	Do.
Do. .	(528) Mr. Amritlal P. Trivedi.	Do. . .	P. L. .	35	21st October 1925.	Do.
Do. .	(529) Do. .	Do. . .	P. L. .	62	Do.	Do.
Do. .	(530) Do. .	Do. . .	P. L. .	47	Do.	Do.
Do. .	(531) Do. .	Do. . .	P. L. .	15	Do.	Do.
Do. .	(532) Do. .	Do. . .	P. L. .	122	16th November 1925.	Do.
Do. .	(533) Do. .	Do. . .	P. L. .	53	20th December 1925.	Do.
Do. .	(534) Do. .	Do. . .	P. L. .	53	19th December 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

District.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Balaghat .	(535) Messrs. Ramnath Baijnath.	Manganese . .	P. L. .	30	19th December 1925.	1 year.
Do. .	(536) Mustt. Munna Bai.	Do. . .	P. L. .	117	11th December 1925.	Do.
Do. .	(537) Mr. Amritlal P. Trivedi.	Do. . .	P. L. .	67	4th November 1925.	Do.
Do. .	(538) Mr. P. N. Oke .	Do. . .	P. L. .	29	22nd November 1925.	Do.
Do. .	(539) Mustt. Munna Bai.	Do. . .	P. L. .	154	11th December 1925.	Do.
Do. .	(540) Messrs. Ramnath and Baijnath Sao.	Do. . .	P. L. .	7	9th December 1925.	Do.
Do. .	(541) Mustt Munna Bai.	Do. . .	P. L. .	119	Do.	Do.
Do. .	(542) Mr. R. P. Mudlair, The Independent Trading Company.	Do . .	P. L. .	17	12th December 1925.	Do.
Do. .	(543) Do. .	Do. . .	P. L. .	44	Do.	Do.
Do. .	(544) Mr. M. B. Marfatia.	Do. . .	P. L. .	32	22nd December 1925.	Do.
Betul .	(545) Bansidhar Ram Niwas.	Coal . . .	M. L. .	105	19th January 1925.	5 years.
Do. .	(546) Pandit Kashi Ram.	Do. . . .	P. L. .	530	9th March 1925.	1 year.
Bhandara .	(547) Seth Jagannath.	Manganese . .	P. L. .	45	23rd May 1925.	Do.
Do. .	(548) Rai Shahib Gowardhandas.	Do. . .	P. L. .	97	18th January 1925.	Do.
Do. .	(549) Messrs. M. D'Costa and Gourduth Ganeshlal	Do. . .	P. L. .	26	4th May 1925.	Do.
Do. .	(550) Mr. Abdur Rahim Khan.	Do. . .	P. L. .	118	1st April 1925.	Do.
Do. .	(551) Messrs. M. D'Costa and Gourduth Ganeshlal.	Do. . .	P. L. .	23	3rd January 1925.	Do.
Do. .	(552) Do. .	Do. . .	P. L. .	91	Do. .	Do.
Do. .	(553) Mr. Shriram Seth.	Do. . .	P. L. .	2	26th June 1925.	Do.
Do. .	(554) Messrs. Ganpatsao and Dhanpatsao	Do. . .	P. L. .	28	18th May 1925.	Do.
Do. .	(555) Seth Jagannath.	Do. . .	P. L. .	55	31st March 1925.	Do.
Do. .	(556) Mr. Malhar Rao Bhao.	Do. . .	P. L. .	174	2nd November 1925.	Do.
Do. .	(557) Mr. Bakaram Singh.	Do. .	P. L. .	69	7th May 1925	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres	Date of commencement.	Term.
Bhandara .	(558) Mr. Rangya Naidu.	Manganese .	P. L. .	117	21st May 1925.	1 year.
Do. .	(559) Lala Jainarain Mohonlal.	Do. . .	P. L. .	211	17th March 1925.	Do.
Do. .	(560) Seth Laxminarain Hardeo.	Do. . .	P. L. .	365	20th June 1925.	Do.
Do. .	(561) Mr. Ganeshlal Balbhadai.	Do. . .	P. L. .	193	19th May 1925.	Do.
Do .	(562) Mr. Bakanum Singh	Do. .	P. L. .	199	14th May 1925.	Do.
Do. .	(563) Messrs. Ganpatsao and Dhanpatsao.	Do. . .	P. L. .	151	16th March 1925.	Do.
Do. .	(564) Mr. S. Rangaya Naidu.	Do. . .	P. L. .	132	16th December 1925.	Do.
Do. .	(565) Messrs. Ganeshlal and Balbhadai	Do. . .	P. L. .	547	20th May 1925.	Do.
Do. .	(566) Mr. Gaupatrao Laxmanrao.	Do. . .	P. L. .	280	6th May 1925	Do.
Do. .	(567) Messrs. Ganpatsao and Dhanpatsao.	Do. . .	P. L. .	77	11th June 1925.	Do.
Do. .	(568) Messrs R. K. Chullany and Sons.	Do. . .	P. L. .	174	6th April 1925.	Do.
Do. .	(569) Messrs Ganpatsao and Dhatpatsao	Do. . .	P. L. .	39	18th May 1925.	Do.
Do. .	(570) Lala Baljnath .	Do. . .	P. L. .	980	11th May 1925.	Do.
Do. .	(571) Do. .	Do. . .	P. L. .	89	Do. .	Do.
Do. .	(572) Messrs. Nilkantsao and Company.	Do . .	P. L. .	105	7th October 1925.	Do.
Do. .	(573) Mr. Parmanand Dayaram.	Do. . .	P. L. .	71	10th December 1925.	Do.
Do. .	(574) Mr. Shriram Seth.	Do. . .	P. L. .	29	7th August 1925.	Do.
Do. .	(575) Mr. M. A Pasha, Minor.	Do. . .	P. L. .	25	25th October 1925.	Do.
Do. .	(576) Messrs. Yadulal and Bhadulal.	Do. . .	P. L. .	14	24th April 1925.	Do.
Do. .	(577) Messrs. Ganeshlal and Balbhadar.	Do . .	P. L .	5	19th May 1925.	Do.
Do. .	(578) Messrs. Ganeshlal and Balbhadar.	Do. . .	P. L. .	240	14th August 1925.	Do.
Do. .	(579) R. S. Seth Gowardhandas.	Do. . .	P. L. .	26	28th October 1925.	Do.
Do. .	(580) Mr. Mangal Singh.	Do. . .	P. L. .	764	2nd October 1925.	Do.

P. L.=Prospecting License. M. L.=Mining Lease.

CENTRAL PROVINCES—*contd.*

DISTRICT	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Bhandara	(581) Messrs. Namdeo Pandurang Dalal's firm.	Manganese .	P. L. .	218	22nd December 1925.	1 year.
Do. .	(582) Messrs. Ganeshlal and Balbhadar.	Do. . .	P. L. .	14	4th August 1925.	Do.
Do. .	(583) Messrs. Ganpatsao and Dhanpatsao.	Do. . .	P. L. .	55	12th September 1925.	Do.
Do. .	(584) Messrs. Nilkantsao and Company.	Do. . .	P. L. .	107	28th May 1925.	Do.
Do.	(585) Mr. G. R. Tataday.	Do. . .	P. L. .	85	9th July 1925.	Do.
Do. .	(586) Messrs. Yadulal and Bhadulal.	Do . .	P. L. .	78	5th July 1925.	Do.
Do. .	(587) Do. .	Do. . .	P. L. .	12	13th October 1725.	Do.
Do. .	(588) Mr. Samiulla Khan.	Do. . .	P. L. .	38	15th August 1925.	Do.
Do. .	(589) Mr. P. N Oke .	Do. . .	P. L. .	596	7th September 1925.	Do.
Do. .	(590) Mr. Mohonlal Birdichand.	Do. . .	P. L. .	70	22nd October 1925.	Do.
Do. .	(591) Messrs Ramnarain and Jagannath.	Do . .	P L. .	48	18th November 1925.	Do.
Do. .	(592) R. S. Seth Gowardhandas.	Do. . .	P. L. .	104	5th November 1925.	Do.
Do. .	(593) Messrs. Nilkantsao and Company.	Do. . .	P. L. .	71	7th September 1925.	Do.
Do. .	(594) Do. .	Do . .	P. L. .	74	8th December 1925.	Do.
Do. .	(595) R. S. Seth Gowardhandas.	Corundum . .	P. L. .	67	17th December 1925.	Do.
Do. .	(596) Do. .	Do. . .	P. L. .	9	Do. .	Do.
Do. .	(597) Do. .	Do . .	P. L. .	32	Do. .	Do.
Do. .	(598) Messrs. Gangaram and Vithoba.	Manganese . .	P. L. .	372	14th November 1925.	Do.
Do. .	(599) Mr. Bansidar Ramnivas.	Do. . .	M. L. .	134	15th June 1925.	10 years.
Do. .	(600) R. S. Seth Gowardhandas.	Do. . .	M. L. .	33	27th May 1925.	5 years.
Do. .	(601) Seth Shriram .	Do. . .	M. L. .	4	12th October 1925.	10 years.
Do. .	(602) R. S. Seth Gowardhandas.	Do. . .	M. L. .	7	21st September 1925.	5 years.
Bilaspur .	(603) Messrs. Agarwala Brothers.	Mica . . .	P. L. . (renewal)	247	25th April 1925.	1 year.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Bilaspur .	(604) [illegible] Bros. [illegible]	Coal . . .	P. L. (renewal)	11,736	1st July 1925.	Up to 8th March 1926.
Do. .	(605) Messrs. Agarwala Brothers.	Mica . . .	P. L. (renewal)	11	26th May 1925.	1 year.
Do. .	(606) Messrs. Dunlop Bros. & Co.	Coal . . .	P. L. .	12,256	1st July 1925.	Do.
Do. .	(607) Messrs. Agarwala Brothers.	Mica . . .	P. L. .	19	4th September 1925.	Do.
Do. .	(608) Messrs. Dunlop Bros. & Co.	Coal . . .	P. L. (renewal)	3,376	6th November 1925.	Do.
Chanda .	(609) Mr. Vadilal Raghuraji of Bombay.	Do. . . .	P. L. .	900	19th February 1925.	Do.
Do. .	(610) Do. .	Do. . . .	P. L. .	171	Do.	Do.
Do. .	(611) Messrs. Maharaj Kishan & Co., of Chhindwara.	Do. . . .	P. L. .	630	26th May 1925.	Do.
Do. .	(612) Do .	Do. . . .	P. L. .	668	5th October 1925.	Do.
Do. .	(613) Messrs. Hajikhoy Lalji & Co., Proprietors, Mahakali Coal Mine, Chanda.	Do. . .	P. L. .	160	5th November 1925.	Do.
Chhindwara	(614) Chaitram Sao Tikaram Sao.	Do. . . .	P. L. .	95	22nd March 1925.	Do.
Do. .	(615) Seth Hazarimal Bazaz.	Manganese . .	P. L. .	73	16th April 1925.	Do.
Do. .	(616) Mr. H. S. Zahiruddin, Vakil and Contractor.	Coal . . .	P. L. .	172	29th May 1925.	Do.
Do. .	(617) Do. .	Do. . . .	P. L. .	389	14th January 1925.	Do.
Do. .	(618) Do. .	Do. . . .	P. L. .	383	Do. .	Do.
Do. .	(619) Do. .	Do. . . .	P. L. .	120	Do. .	Do.
Do. .	(620) Mr. Samiulla Khan, Malguzar.	Manganese . .	P. L. .	68	17th April 1925.	Do.
Do. .	(621) Captain Leonard Newton.	Coal . . .	P. L. .	119	2nd February 1925.	Do
Do. .	(622) Mr. Noor Mohamad Mitha.	Do. . . .	P. L. .	196	10th October 1925.	Do.
Do. .	(623) Seth Hazarimal Bazaz.	Manganese . .	P. L. .	71	9th March 1925	Do.
Do. .	(624) R. S. Mathura Prasad Motilal & Co.	Coal . . .	P. L.	191	2nd October 1925.	Do.
Do. .	(625) Mr. Pritul Narayan Mukerji.	Do. . . .	P. L. .	242	16th June 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Chhindwara	(626) Messrs. M. D'Costa and Gouridatta Ganeshlal.	Manganese . .	P. L. .	57	23rd September 1925.	1 year.
Do. .	(627) Mr. Ramji Gangaji, Contractor.	Do. . .	P. L. .	69	24th June 1925.	Do.
Do. .	(628) Do. .	Do. . .	P. L. .	4	Do.	Do.
Do. .	(629) Do. .	Do. . .	P. L. .	41	2nd October 1925.	Do.
Do. .	(630) Do. .	Do. . .	P. L. .	60	Not given .	Do.
Do. .	(631) Thakur Randhir Shah, Jagairdar.	Coal . . .	P. L.	115	24th September 1925.	Do.
Do. .	(632) Mr. Hussain Khan, Contractor.	Manganese . .	P. L. .	43	5th October 1925.	Do.
Do. .	(633) Thakur Randhir Shah, Jagirdar.	Coal . . .	P. L. .	130	24th October 1925.	Do.
Do. .	(634) Do. .	Do. . . .	P. L. .	621	24th September 1925.	Do.
Do. .	(635) Do .	Manganese . .	P. L. .	443	5th December 1925.	Do.
Do. .	(636) Hussain Khan, Contractor.	Do. . .	P. L. .	93	28th November 1925.	Do.
Do. .	(637) Not available	Do. . .	P. L. .	85	2nd November 1925.	Do.
Do. .	(638) Rao Sahib D. Laxmi Narayan, Kamptee.	Do. . .	P. L. .	524	4th November 1925.	Do.
Do. .	(639) Mr. Ramji Gangaji, Contractor.	Do. . .	P. L. .	110	2nd December 1925.	Do.
Do. .	(640) Messrs. B. Fouzdar & Bros.	Do. . .	M. L. .	14	8th January 1925.	30 years.
Do. .	(641) Seth Kanhayalal Laxmi Narayan.	Do. . .	M. L. .	148	22nd May 1925.	Do.
Do. .	(642) Messrs. B. Fouzdar & Bros.	Do. . .	P. L. .	17	19th March 1925.	Do.
Drug . .	(643) Seth Ramprasad Laxmi Narayan of Kamptee.	Galena . .	P. L. .	14	28th November 1925.	Do.
Hoshangabad	(644) Pandit Thakur Prasad Awasthy, Banker, Betul.	Coal . .	P. L. . (renewal)	226	12th January 1925.	Do.
Do. .	(645) Do. .	Do. . . .	P. L. .	50	27th January 1925.	Do.
Jubbulpore	(646) Messrs. Gupta & Sons.	Manganese . .	P. L. .	45	28th January 1925.	Do.
Do. .	(647) Mr. P. C. Datta.	Do. . .	P. L. .	151	22nd June 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

District.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Jubbulpore.	(648) Mr. C. Stanley Harris.	Manganese . .	M. L. .	31	23rd March 1925.	30 years.
Do. .	(649) Messrs. Gupta & Sons.	Do. . .	P. L. .	13	16th January 1925.	Do.
Do. .	(650) Mr. M. B. Mar-	Do. . .	P. L. .	94	3rd February 1925.	Do.
Do.	[illegible] Amin-uddin	Do. . .	P. L. .	3	6th February 1925.	Do.
Do. .	(652) Do. .	Do. . .	P. L. .	41	Do.	Do.
Do. .	(653) Seth Hazarimal.	Do. . .	P. L. .	69	6th January 1925.	Do.
Do. .	(654) Messrs Byramji Pestonji.	Do. . .	M. L. .	16	24th February 1925.	5 years.
Do. .	(655) Ganpat Sao Dhanpat Sao.	Do . .	P. L. .	28	6th February 1925.	1 year.
Do. .	(656) Do. .	Do. . .	P. L. .	24	Do. .	Do.
Do. .	(657) Do. .	Do. . .	P. L. .	52	Do. .	Do.
Do. .	(658) Laxminarain Hardeo.	Do. . .	P. L. .	153	18th February 1925.	Do.
Do. .	(659) Do. .	Do. . .	P. L. .	89	5th March 1925.	Do.
Do. .	(660) Madhulal Doogar & Sons.	Do. . .	P. L. .	15	18th November 1925.	Do.
Do. .	(661) Messrs. Ganpat Rao Laxman Rao.	Do. . .	P. L. .	60	28th September 1925.	Do.
Do. .	(662) Mr. Chakorilal Pathak.	Bauxite . .	P. L. .	22	5th May 1925	Do.
Do. .	(663) Messrs. Gupta & Sons.	Manganese .	P. L. .	153	23rd August 1925.	Do.
Do. .	(664) Mr. Gupaldas Nemichand.	Do. . .	P. L. .	11	23rd July 1925.	Do.
Do. .	(665) Messrs. Gupta & Sons.	Do. . .	P. L. .	128	8th November 1925.	Do.
Do. .	(666) Sukhdeo Prasad Radhakishan.	Do. . .	P. L. .	262	14th May 1925.	Do.
Do. .	(667) Do. .	Do. . .	M. L. .	14	5th September 1925.	30 years.
Do. .	(668) Messrs. Gupta & Sons.	Do. . .	P. L. .	68	3rd August 1925.	1 year.
Do. .	(669) Do. .	Do. . .	P. L. .	134	8th November 1925.	Do.
Do. .	(670) Mr. P. C. Datt .	Do. . .	M. L. .	3	2nd October 1925.	30 years.
Do. .	(671) Messrs. Sukhdeo Prosad Radhakishan	Do. . .	P. L. .	327	16th December 1925.	1 year.

P. L. = *Prospecting Licence.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Jubbulpore.	(672) Mr. C. Stanley Harris.	Manganese . .	P. L. .	75	19th November 1925.	1 year.
Do. .	(673) Do. .	Do. . .	P. L. .	12	Do. .	Do.
Do. .	(674) Do. .	Do. . .	P. L. .	72	7th November 1925.	Do.
Do. .	(675) Do. .	Do. . .	P. L. .	35	2nd November 1925.	Do.
Do. .	(676) Do. .	Do. . .	P. L. .	127	Do. .	Do.
Do. .	(677) Do.	Do. . .	P. L. .	93	11th December 1925.	Do.
Do. .	(678) Seth Pratap Laxman Rao.	Do. . .	P. L. .	102	9th November 1925.	Do.
Do. .	(679) Mr. P. C. Bose .	Do. . .	P. L. .	90	16th December 1925.	Do.
Mandla .	(680) Messrs. Debi Prasad Bania of Raipur and Chhedilal Choudhury.	Mica . . .	P. L. .	86	4th April 1925.	Do.
Do. .	(681) Do. .	Do. . .	P. L. .	14	7th August 1925.	Do.
Do. .	(682) Messrs. J. Reid and Russell of Jubbulpore.	Copper, Lead, Mica, Zinc and Manganese.	P. L. .	399	31st October 1925.	Do.
Do. .	(683) Messrs. D. B. Ballabhdas Mannolal Kanhaiyalal of Jubbulpore.	Manganese, Tin, Zinc, Copper and Mica.	P. L.	100	10th December 1925.	Do.
Do. .	(684) Messrs. Punamchand Kishanlal of Seoni.	Manganese . .	P. L. .	99	22nd October 1925.	Do.
Do. .	(685) Messrs. J. Reid and Russell of Jubbulpore.	Mica, Zinc, Copper, Lead, Silver and Manganese.	P. L. .	10	2nd September 1925.	Do.
Nagpur .	(686) Goswami Moheshpuri, Nagpur.	Manganese . .	P. L. .	133	2nd February 1925.	Do.
Do. .	(687) Seth Kanhyalal Laxminarain Bagdi of Sindi.	Do. . .	P. L. .	875	11th September 1925.	Do.
Do. .	(688) Mr. Ganpat Rao Laxman Rao of Nagpur.	Do. . .	P. L. .	168	19th January 1925.	Do.
Do. .	(689) Mr. M. A. Razaq of Kamptee.	Do. . .	P. L. .	16	2nd March 1925.	Do.
Do. .	(690) R. S. Minamal Nandlal of Chhindwara.	Do. . .	P. L. .	44	28th February 1925.	Do.
	(691) Messrs. Hariram and Maniram of Hewra.	Do. . .	P. L. .	21	23rd February 1925.	Do.

P. L. = Prospecting License. M. L. = Mining Lease.

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Nagpur .	(692) Seth Raghunathdas Bharuka of Kamptee.	Manganese . .	P. L. .	64	12th April 1925.	1 year.
Do. .	(693) Do. .	Do. . .	P. L. .	292	Do. .	Do.
Do. .	(694) Messrs. Hariram and Maniram of Hewra.	Do. . .	P. L. .	56	1st April 1925	Do.
Do. .	(695) Seth Jagannath of Tumsar.	Do. . .	P. L. .	46	3rd February 1925.	Do.
Do. .	(696) Messrs. Maharaj Kisan and Company.	Do. . .	P. L. .	236	28th February 1925.	Do.
Do. .	(697) Mr. Nur Mohmad Mitha of Nagpur.	Do. . .	P. L. .	272	10th July 1925.	Do.
Do. .	(698) Hariram and Maniram of Hewra.	Do. . .	P. L. .	62	23rd February 1925.	Do.
Do. .	(699) Mr. S. Rangaya Naidu of Nagpur.	Do. . .	P. L. .	63	2nd January 1925.	Do.
Do. .	(700) Messrs. Hariram and Maniram of Hewra.	Do. . .	P. L. .	48	23rd February 1925.	Do.
Do. .	(701) Do. .	Do. . .	P. L. .	48	27th February 1925.	Do.
Do. .	(702) Mr. Erachshah 1, Pleader, Kamptee.	Do. . .	P. L. .	52	4th February 1925.	Do.
Do. .	(703) Seth Laxminarain Hardeo of Kamptee.	Do. . .	P. L. .	133	10th February 1925.	Do.
Do. .	(704) Messrs. Gupta and Sons, Nagpur.	Do. . .	P. L. .	30	3rd August 1925.	Do.
Do. .	(705) Sir M. B. Dadabhoy, Barrister-at-Law, Nagpur.	Do. . .	P. L. .	50	13th July 1925.	Do.
Do. .	(706) Mr. Nur Muhmad Mitha of Nagpur.	Do. . .	P. L. .	245	10th August 1925.	Do.
Do. .	(707) Mr. M. A. Razaq of Kamptee.	Do. . .	P. L. .	79	3rd September 1925.	Do.
Do. .	(708) Lala Jainarain Mohonlal, Nagpur.	Do. . .	P. L. .	68	17th March 1925.	Do.
Do. .	(709) Mr. S. Vinaik Rao, Nagpur.	Do. . .	P. L. .	400	23rd January 1925.	Do.
Do. .	(710) Sir M. B. Dadabhoy, Barrister-at-Law, Nagpur.	Do. . .	P. L. .	103	13th July 1925.	Do.
Do. .	(711) Do. .	Do. . .	P. L. .	213	Do. .	Do.
Do. .	(712) Mr. S. Vinaik Rao, Nagpur.	Do. . .	P. L. .	6	6th May 1925	Do.
Do. .	(713) Seth R. K. Chhullani and Sons, Kamptee.	Do. . .	P. L. .	344	6th June 1925	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Nagpur	(714) Mr. Jumnadas Potdar, Nagpur.	Manganese . .	P. L. .	57	17th August 1925.	1 year.
Do.	(715) Do. .	Do. . .	P. L. .	85	Do. .	Do.
Do.	(716) Do. .	Do. . .	P. L. .	252	Do. .	Do.
Do.	(717) Seth Raghunathdas Bharuka of Kamptee.	Do. . .	P. L.	11	12th April 1925.	Do.
Do.	(718) The Turabali Manwarali Syndicate, Nagpur.	Do. . .	P. L. .	38	14th February 1925.	Do.
Do.	(719) Mr. Moheshpuri of Nagpur.	Do. . .	P. L. .	350	21st April 1925.	Do.
Do.	(720) Messrs. Kallooram and Company, Kamptee.	Do. .	P. L. .	16	30th January 1925.	Do.
Do.	(721) Mr. S. Vinaik Rao, Nagpur.	Do. .	P. L. .	9	8th September 1925.	Do.
Do.	(722) Mr. Nurmahmad Mitha, Nagpur.	Do.	P. L.	294	10th August 1925.	Do.
Do.	(723) Goswami Moheshpuri, Nagpur.	Do.	P. L. .	103	12th February 1925.	Do.
Do.	(724) Lala Jainarain Mohonlal, Nagpur.	Do.	P. L.	59	17th March 1925.	Do.
Do.	(725) Seth Gopaldas Nemichand, Kamptee.	Do.	P. L.	93	10th October 1925.	Do.
Do.	(726) Messrs. R. K. Chhullani and Sons, Kamptee.	Do	P. L.	56	6th June 1925	Do.
Do.	(727) Messrs. B. Fouzdar and Brothers of Nagpur.	Do . .	P. L.	80	4th May 1925	Do.
Do.	(728) Mr. P. M. Markar, Bombay.	Do.	P. L.	131	30th June 1925.	Do.
Do.	(729) Seth Raghunathdas Bharuka, Kamptee.	Do.	P. L. .	155	12th April 1925.	Do.
Do.	(730) Messrs. Nasarwanji and Ardeshir Brothers, Tirodi.	Do. . .	P. L. .	9	22nd October 1925.	Do.
Do.	(731) The Firm of Namdeo Pandurang and others of Bhandara.	Do. . .	P. L.	60	28th September 1925.	Do.
Do.	(732) Messrs. Hariram and Maniram of Hewra.	Do. . .	P. L. .	169	13th August 1925.	Do.
Do.	(733) The Coal Bunkering and Shipping Company, Calcutta.	Do. . .	P. L. .	593	3rd December 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Nagpur .	(734) Messrs. Kashiram and Patiram of Hewra.	Manganese . .	P. L. .	101	18th June 1925.	1 year.
Do. .	(735) Mr. Erachsha, Pleader, Kamptee.	Do. . .	P. L. .	56	3rd September 1925.	Do.
Do. .	(736) Messrs. N. Rustomji and M. Chakrabarty of Nagpur.	Do. . .	P. L. .	93	19th February 1925.	Do.
Do. .	(737) Mr. M A. Razaq, Kamptee.	Do. . .	P. L. .	218	6th June 1925	Do.
Do. .	(738) Mr. Laxman Damodhar Lele of Nagpur.	Do. . .	P. L. .	49	2nd September 1925.	Do.
Do. .	(739) Messrs. Puranlal and Syed Azmuddin of Nagpur.	Do. . .	P. L. .	102	13th May 1925.	Do.
Do. .	(740) Mr. Akbarali Manwarali of Nagpur.	Do. . .	P. L. .	69	6th June 1925.	Do.
Do. .	(741) Messrs. N. Rustomji and M. Chakraborty of Nagpur.	Do. .	P. L. .	25	12th May 1925.	Do.
Do. .	(742) Do. .	Do. . .	P. L. .	27	28th September 1925.	Do.
Do. .	(743) Dr. B. D. Vyas, Kamptee.	Do. . .	P. L.	20	26th May 1925.	Do.
Do. .	(744) Mr. Jetha Radha of Nagpur.	Do. . .	P. L. .	144	8th May 1925.	
Do. .	(745) Seth Bhopat, Rao Malguzar, Seoni.	Do. . .	P. L. .	116	24th October 1925.	Do.
Do. .	(746) Messrs Gupta & Sons of Nagpur.	Do. . .	P. L. .	150	29th October 1925.	Do.
Do. .	(747) Messrs. N. Rustomji and M. Chakraborty of Nagpur.	Do. . .	P. L. .	10	28th September 1925.	Do.
Do. .	(748) Messrs. Gupta and Sons of Nagpur.	Do. . .	P. L. .	97	21st September 1925.	Do.
Do. .	(749) Mr. Sayad Hefzul Raquib of Walgaon.	Do. . .	P. L. .	64	14th August 1925.	Do.
Do. .	(750) Seth Shuklaan Hazarimal of Kamptee.	Do. . .	P. L. .	20	18th September 1925.	Do.
Do. .	(751) Messrs. Puranlal Bapusao and Syed Azimuddin of Nagpur.	Do. . .	P. L. .	31	13th May 1925.	Do.
Do. .	(752) Sir M. B. Dadabhoy, Bar.-at-Law. Nagpur.	Coal . . .	P. L. .	802	3rd December 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Nagpur .	(753) Messrs. Puranlal Bapusao and Syed Azimuddin of Nagpur.	Manganese .	P. L. .	230	13th May 1925.	1 year.
Do. .	(754) Mr. Shamji Naralnji, Ramtek.	Do. . .	P. L. .	78	5th October 1925.	Do.
Do. .	(755) Do. .	Do . .	P. L. .	17	24th November 1925.	Do.
Do.	(756) Messrs. M. D' Costa and Goredutt Ganeshlal, Nagpur.	Do . .	P. L. .	186	7th October 1925.	Do.
Do. .	(757) Mr. Shamji Naralnji, Ramtek.	Do . .	P. L. .	39	5th October 1925.	Do.
Do. .	(758) Messrs. Ganpatsao and Dhanpatsao of Andhergaon.	Do. . .	P. L. .	78	18th September 1925.	Do.
Do. .	(759) Mr. Shamji Naralnji, Ramtek.	Do . .	P. L. .	57	24th November 1925.	Do.
Do. .	(760) Seth Akbarali Manwarali of Nagpur.	Do. . .	P. L .	10	17th November 1925.	Do.
Do. .	(761) Messrs. Bholanathdas & Co., Calcutta.	Do. . .	P. L. .	44	16th September 1925.	Do.
Do. .	(762) Seth Raghunathdas Bharuka of Kamptee.	Do. . .	P. L. .	234	10th October 1925.	Do.
Do. .	(763) Goswami Meheshpuri, Nagpur.	Do. . .	P. L. .	150	13th November 1925.	Do.
Do. .	(764) R. S. Seth Gowardhandas of Tumsar	Do. . .	P. L. .	3	16th September 1925.	Do.
Do. .	(765) Mr. Govind Ragho Labade of Ramtek.	Do. . .	P. L. .	230	15th October 1925.	Do.
Do. .	(766) Mr. S. Vinaik Rao of Nagpur.	Do. . .	P. L. .	78	30th September 1925.	Do.
Do. .	(767) Mr. K. S. Muhammad Yakub, Kamptee.	Do . .	P. L. .	26	18th November 1925.	Do.
Do. .	(768) Seth Mohonlal Bedrichand, Kamptee.	Do. . .	P. L. .	75	6th November 1925.	Do.
Do. .	(769) Messrs. Gupta and Sons, Nagpur.	Do. . .	P. L. .	39	29th October 1925.	Do.
Do. .	(770) Mr. Ganpat Rao Laxman Rao of Nagpur.	Do. . .	P. L. .	97	14th November 1925.	Do.
Do. .	(771) Khan Sahib Muhammad Yakub of Kamptee.	Do. . .	P. L.	551	18th November 1925.	Do.

P. L. = Prospecting License, M. L. = Mining Lease.

CENTRAL PROVINCES—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Nagpur .	(772) Messrs. Bholanathdas & Co., Calcutta.	Manganese . .	P. L. .	9	14th November 1925.	1 year.
Do. .	(773) Messrs. Gupta & Sons of Nagpur.	Do. . .	P. L. .	27	29th October 1925.	Do.
Do. .	(774) Messrs. Hariram and Maniram of Hewra.	Do. . .	P. L. .	93	17th November 1925.	Do.
Do. .	(775) Sir M. B. Dadabhoy, Bar.-at-Law of Nagpur.	Do. . .	P. L. .	145	13th July 1925.	Do.
Do. .	(776) Goswami Moheshpuri of Nagpur.	Do. . .	M. L. .	77	17th February 1925.	5 years.
Do. .	(777) Do. .	Do. . .	M. L. .	35	17th February 1925.	Do.
Do. .	(778) Mr. Shamji Narainji.	Do. . .	M. L. .	14	23rd February 1925.	15 years.
Do. .	(779) The Central Provinces Manganese Ore Co., of Nagpur.	Do. .	M. L. . Supplementary.	17	4th March 1925.	Will expire with the original lease to which it is supplementary.
Do. .	(780) Seth Laxminarain Hardeo, Kamptee.	Do. .	M. L. .	43	8th April 1925.	5 years.
Do. .	(781) Rai Sahib Seth Gowardhandas, Tumsar.	Do. . .	M. L. .	33	27th May 1925.	15 years.
Do.	(782) Goswami Moheshpuri of Nagpur.	Do. . .	M. L. .	14	5th November 1925.	10 years.
Do. .	(783) Seth Gopaldas Nemichand, Kamptee.	Do. . .	M. L. .	26	13th November 1925.	3 years.
Do. .	(784) Rai Sahib Seth Gowardhandas of Tumsar.	Do. . .	M. L. .	37	27th May 1925.	30 years.
Do. .	(785) Syed Hifzul Raquib, Malguzar of Waigaon.	Do. . .	M. L. .	48	14th August 1925.	10 years.
Narsingpur	(786) Mr. C. Stanley Harris of Balaghat.	Copper . .	M. L. .	222	21st May 1925.	30 years.
Seoni .	(787) Seth Parmanand Bansidher.	Manganese . .	P. L. .	244	8th July 1925.	1 year.
Do. .	(788) Do. .	Do. . .	P. L. .	50	14th March 1925.	Do.
Wardha .	(789) Krishnarao Anandrao Meghe of Borgaon tahsil and dist. Wardha.	Do. . .	P. L. .	145	27th February 1925.	Do.
Do. .	(790) Do. .	Copper . .	P. L. .	144	27th February 1925.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

MADRAS.

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Anantapur .	(791) Nabi Sahib of Hindupur.	Barytes . .	P. L. .	22·25	1st September 1925.	1 year.
Do. .	(792) The N. Anantapur Gold Mines Co., Ltd.	Gold . . .	P. L. .	1,616	21st July 1925.	Do.
Do. .	(793) Do.	Do. . .	M. L. .	1,604	*	30 years.
Bellary .	(794) M. R. Ry. A. Pitchayya Nayudu.	Manganese . .	P. L. .	640	24th September 1925.	1 year.
Do. .	(795) K. Ramchandra.	Do. . .	P. L. .	107·36	10th July 1925.	Do.
Do. .	(796) Do. .	Clay . . .	P. L. .	200	15th April 1925.	Do.
Do. .	(797) K. Abdul Hye.	Manganese . .	M. L. .	46·30	30th April 1925.	30 years.
Do. .	(798) Vegarazu Venkatasubbayya Pantulu.	Do. . .	P. L.	2,979	23rd November 1925.	1 year.
Do. .	(799) A. E. Robinson, Esq.	Do. . .	P. L. .	451·77	8th July 1925.	Do.
Do. .	(800) Vegarazu Venkatasubbayya.	Do. . .	P. L. .	2·05	15th April 1925.	Do.
Do. .	(801) B. Ismail Sahib	Do. . .	P. L. .	161·3	3rd * November 1925.	Do.
Do. .	(802) K. Abdul Hye.	Do. .	P. L. .	1,503·16	8th April 1925.	Do.
Do. .	(803) A. Pitchayya Naidu.	Do. . .	M. L. .	360	5th August 1925.	6 months.
Cuddapah .	(804) Mysore Dev. Syndicate.	Asbestos . .	P. L. .	30·51	9th November 1925.	1 year.
Do. .	(805) Nabi Sahib of Hindupur.	White clay .	M. L. * .	6·94	†	5 years.
Do. .	(806) A. Ghose of Calcutta.	Do. . .	P. L. .	127·58	22nd July 1925.	1 year.
Do. .	(807) K. Venkatesia of Thumkur.	Do. . .	P. L. .	39·65	9th November 1925.	Do.
Kurnool .	(808) V. Venkatasubbayya.	Do. . .	M. L. .	22·25	2nd March 1925.	30 years.
Do. .	(809) V. Venkatasubbayya.	Barytes . .	M. L. .	1·45	2nd March 1925.	Do.
Do. .	(810) B. P. Sesha Reddi.	Do. . .	M. L. .	1·55	2nd February 1925.	Do.
Do. .	(811) Do. .	Do. . .	M. L. .	45·50	2nd March 1925.	Do.
Do. .	(812) Do. .	Manganese . .	M. L. .	46·00	2nd February 1925.	Do.
Do. .	(813) E. H. Rushton	Iron-ore . .	P. L. .	53·06	20th October 1924.	1 year.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*
* Lease not yet executed.
† Not yet commenced.

MADRAS—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Kurnool .	(814) V. Venkatasubbayya.	Barytes . .	P. L. .	6 00	11th August 1925.	1 year.
Do. .	(815) Do. .	Do. . .	P. L. .	4 00	Do. .	Do.
Malabar .	(816) H. W. Perry .	Gold . . .	M. L. .	160 00	25th November 1925.	20 years.
Nellore .	(817) The Madras Mica Company Ltd., Gundur.	Mica . . .	M. L. .	51 56	4th August 1925.	Do.
Do. .	(818) M. R. Ry. K. C. Narasimhachari.	Do. . . .	M. L. .	190 48	28th November 1925.	30 years.
Do. .	(819) Do. .	Do. . . .	M. L. .	117·39	11th January 1925.	Do.
Do. .	(820) The Krishna Mining Company, Gunlur.	Do . . .	M. L. .	71·13	11th December 1925.	Do.
Do. .	(821) Do. .	Do. . . .	M. L. .	175 76	Do. .	Do.
Do. .	(822) S. V. Subba Reddi Garu.	Do. . .	P. L. .	87 20	12th August 1925.	1 year.
Do. .	(823) The Sankara Mining Syndicate, Nellore.	Do. . .	M. L. .	3 52	17th June 1925.	30 years.
Do. .	(824) P. Chenga Reddi of Nellore.	Do. . .	M L.	127 80	28th September 1925.	Do.
Do. .	(825) C. Venkatarama Chetti of Nillatur.	Do. . .	P. L	27 73	Do. .	1 year.
Do. .	(826) Y. Subba Reddi of Getlapalem.	Do. . .	P. L .	6 29	27th July 1925.	Do.
Do. .	(827) V. Lakshmi Narasayya.	Do. . . .	P. L	53 86	1st September 1925.	Do.
Do. .	(828) Do. .	Do. . .	P L. .	9 63	Do. .	Do.
Do. .	(829) I. Ramsubba Reddi.	Do. .	M. L. .	3 90	1st July 1925	30 years.
Do. .	(830) Do. .	Do. .	M. L. .	12 75	18th August 1925.	Do.
Do. .	(831) S. V. Subba Reddi Garu.	Do. . .	P. L.	16 03	12th August 1925.	1 year.
Do. .	(832) P. Chenga Reddi, Nellore.	Garnet .	P. L. .	54·79	18th December 1925.	Do.
Do. .	(833) P. Venkatasubba Reddi of Gudur.	Mica . . .	P. L. .	56·75	28th September 1925.	Do.
Do. .	(834) V. Venkatasubbayya Nayudu of Gudur.	Not available .	P. L. .	15 03	31st October 1925.	Do
Do. .	(835) C. Venkatarami Chetti, Nillatur.	Mica . . .	M. L. .	6·52	28th September 1925.	30 years.
Salem .	(836) R. Alagappa Mudaliyar.	Corundum . .	M. L. .	677·70	24th September 1924.	Do.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

MADRAS—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Salem .	(837) S. Srinivasaraghavan.	Iron, Chromite and Manganese.	P. L. .	1,220·34	30th March 1925.	1 year.
The Nilgiris	(838) A. H. Gaston .	Mica . . .	M. L. .	46 00	9th January 1925.	29 years.
Do. .	(839) F. W. Mansfield and partners.	Do. . . .	P. L. .	50 00	21st October 1925.	1 year.
Do .	(840) Do. .	Do. . . .	P. L. .	469 08	16th May 1925.	Do.

NORTH-WEST FRONTIER PROVINCE.

Hazara .	(841) R. B. Rocha Ram & Sons.	Coal and carbonaceous clay.	P. L. .	4	5th December 1925.	1 year.

PUNJAB.

Attock .	(842) Whitehall Petroleum Corporation Limited.	Mineral oil . .	P. L. .	2,016	6th March 1925.	1 year.
Jhelum .	(843) Messrs. Atma Ram Sant Ram Kapur.	Coal . . .	M. L. .	420	2nd October 1925.	30 years.
Do. .	(844) R. Rahimullah Khan of Darapur.	Do. . . .	M. L. .	60	1st April 1925.	Do.
Do. .	(845) Pandit Gian Chand, Dandot.	Do. . . .	M. L. .	117 25	1st June 1925	Do.
Do. .	(846) M. Feroze Khan and Pir Star Shah, Retucha.	Do. . . .	M. L. .	28	1st January 1925.	5 years.
Do. .	(847) Pandit Gian Chand.	Do. . . .	P. L. .	45 ·18	1st June 1925	1 year.
Do. .	(848) Do. .	Do. . . .	P. L. .	89·3	19th August 1925.	Do.
Do. .	(849) Bhai Hazuramal, Dandot.	Do. . . .	P. L. .	6·75	1st June 1925.	Do.
Do. .	(850) Do. .	Do. . . .	P. L. .	23·5	Do. .	Do.
Do. .	(851) Do. .	Do. . . .	P. L. .	22·75	16th September 1925.	Do.
Do. .	(852) Do. .	Do. . . .	P. L. .	18·3	Do. .	Do.

P. L.=Prospecting License. M. L.=Mining Lease.

PUNJAB—*contd.*

DISTRICT.	Grantee.	Mineral.	Nature of grant.	Area in acres.	Date of commencement.	Term.
Jhelum .	(853) L. Gopal Das, Contractor.	Coal . . .	P. L .	164 89	2nd October 1925.	1 year.
Do. .	(854) Do. .	Do. . . .	P. L. .	144 12	Do. .	Do.
Do. .	(855) L. Charanjit Lal, Contractor.	Do. . . .	P. L .	80	22nd May 1925.	Do.
Mianwali .	(856) R. G. Tugwood, London.	Mineral oil . .	P. L. .	1,792	14th January 1925.	Do.
Do. .	(857) Messrs. C Beven Petman & Ishar Das, Kapur.	Coal . . .	M. L. .	455	11th June 1925.	30 years.
Rawalpindi.	(858) Whitehall Petroleum Corporation Ltd.	Mineral oil . .	P. L. .	2,816	3rd March 1925.	1 year.
Shahpur .	(859) Attock Oil Company Ltd., Rawalpindi.	Do. . .	P. L. .	7,040	29th October 1925.	2 years.

P. L. = *Prospecting License.* *M. L.* = *Mining Lease.*

SUMMARY.

Province.	Exploring License	Prospecting License.	Mining Lease.	Total of each Province.
Ajmer-Merwara	..	13	2	15
Assam	..	22	1	23
Baluchistan	1	1	1	3
Bengal	..	7	..	7
Bihar and Orissa	..	8	17	25
Bombay	..	6	2	8
Burma	..	220	16	245
Central Provinces	..	409	55	464
Madras	..	28	22	50
North-West Frontier Province . . .	..	1	..	1
Punjab	..	13	5	18
Total of each kind and grand total for 1925.	1	737	121	859
TOTAL FOR 1924 .	1	654	114	769

CLASSIFICATION OF LICENSES AND LEASES.

TABLE 41.—*Prospecting Licenses and Mining Leases granted in Ajmer-Merwara during the year 1925.*

DISTRICT.	1925.		
	No.	Area in acres.	Mineral.
Prospecting Licenses.			
Ajmer	11	43·83	Mica.
Beawar	1	6·05	Graphite.
Do.	1	0·22	Mica.
TOTAL	13		
Mining Leases.			
Ajmer	2	6·02	Mica.

TABLE 42.—*Prospecting Licenses and Mining Lease granted in Assam during the year 1925.*

DISTRICT.	1925.		
	No.	Area in acres.	Mineral.
Prospecting Licenses.			
Cachar	2	13,883·58	Mineral oil.
Khasi and Jaintia Hills	1	2,518	Do.
Lakhimpur	5	27,520	Oil.
Do.	2	13,120	Coal.
Naga Hills	2	11,392	Mineral oil.
Nowgong	4	9,658	Do.
Sadiya Frontier Tract	1	2,240	Do.
Sibsagar	2	7,840	Coal and oil.
Sylhet	3	18,241	Mineral oil.
TOTAL	22		
Mining Lease.			
Khasi and Jaintia Hills	1	5,817·6	Coal.

TABLE 43.—*Exploring and Prospecting Licenses and Mining Lease granted in Baluchistan during the year 1925.*

District.	1925.		
	No.	Area in acres.	Mineral.
Exploring License.			
Kalat	1	..	Mineral oil.
Prospecting License.			
Kalat	1	3,200	Mineral oil.
Mining Lease.			
Zhob	1	10	Chromite.

TABLE 44.—*Prospecting Licenses granted in Bengal during the year 1925.*

District.	1925.		
	No.	Area in acres.	Mineral.
Prospecting Licenses.			
Chittagong	1	3,061·98	Mineral oil.
Chittagong Hill Tracts . .	6	34,547·24	Do.
TOTAL .	7		

TABLE 45.—*Prospecting Licenses and Mining Leases granted in Bihar and Orissa during the year 1925.*

DISTRICT.	1925.		
	No.	Area in acres.	Mineral.
Prospecting Licenses.			
Patna	1	3,552	All minerals.
Singhbhum	1	340·94	Limestone.
Do.	1	611·00	Iron ore.
Do.	3	361·20	All minerals.
Do.	1	332·50	Chromite.
Do.	1	212·80	Manganese.
TOTAL	8		
Mining Leases.			
Hazaribagh	1	..	Mica.
Santal Parganas	13	40·76	Coal.
Singhbhum	1	1,139·76	Iron and manganese.
Do.	1	6·79	Yellow ochre.
Do.	1	462·71	Manganese.
TOTAL	17		

TABLE 46.—*Prospecting Licences and Mining Leases granted in the Bombay Presidency during the year 1925.*

DISTRICT.	1925.		
	No.	Area in acres.	Mineral.
Prospecting Licenses.			
Belgaum	1	1,072·92	Bauxite.
Do.	1	320	Manganese.
Kanara	2	1,848	Do.
Sukkur	1	6,008·52	Mineral oil.
West Khandesh	1	79·17	Coal, white stone, iron, mica, and oil.
TOTAL	6		

TABLE 46.—*Prospecting Licenses and Mining Leases granted in the Bombay Presidency during the year 1925* (contd.

DISTRICT.	1925.		
	No.	Area in acres.	Mineral.
Mining Leases.			
Kanara	2	126·3	Manganese.

TABLE 47.—*Prospecting Licenses and Mining Leases granted in Burma during the year 1925.*

DISTRICT.	1925.		
	No.	Area in acres.	Mineral
Prospecting Licenses.			
Akyab	5	16,430	Natural petroleum
Do.	1	5,120	Natural petroleum and its associated hydrocarbons.
Amherst	2	2,560	Sulphides
Do.	1	1,280	All minerals
Do.	5	6,157	All minerals except oil.
Do.	2	3,048	Antimony
Do	2	16,800	Mineral oil
Bhamo	1	826	All minerals except natural petroleum and jade.
Kyaukpyu	1	1,280	Natural petroleum.
Kyaukse	2	8,608	Minerals other than mineral oil.
Lower Chindwin . . .	4	8,768	Natural petroleum,
Magwe	18	20,319	Do
Mandalay	1	1,997	All minerals except oil.
Meiktila	1	307	Galena.
Do.	2	4,480	All minerals except oil.
Do.	1	1,850	Natural petroleum.
Meiguı	16	9,950·26	Tin.
Do.	18	16,744 90	All minerals except oil.
Do	24	15,643·92	Tin and allied minerals.
Do	1	657·9	Cassiterite and allied mineral.

TABLE 47.—*Prospecting Licenses and Mining Leases granted in Burma during the year 1925*—contd.

DISTRICT.	1925.		
	No.	Area in acres.	Mineral.
Prospecting Licenses—*contd.*			
Mergui	1	629·8	Tin and wolfram.
Do.	3	3,189·76	Tin and other minerals.
Minbu	1	352·64	All minerals.
Do.	3	3,846·4	Natural petroleum.
Myingyan	12	18,626·84	Do.
Myitkyina	1	8·32	All minerals except oil.
Northern Shan States	1	274·56	All minerals and precious stones.
Pakokku	6	19,706·8	Natural petroleum.
Shwebo	6	26,984·0	Do.
Southern Shan States	9	17,062·4	All minerals except oil.
Tavoy	4	1,817·6	Tin.
Do.	37	18,757·6	Tin and wolfram.
Do	7	4,595·2	All minerals except oil.
Do.	2	825·6	Tin and allied minerals.
Do.	1	396·8	Tin and other minerals.
Thaton	3	3,183·6	All minerals except oil.
Thayetmyo	16	25,964·8	Natural petroleum.
Do.	1	2,444·8	Chromite.
Toungoo	1	640	All minerals except oil.
Upper Chindwin	4	8,160	Natural petroleum.
Do.	1	704	Coal.
Yamethin	1	1,555·2	All minerals except oil.
TOTAL	229		
Mining Leases.			
Amherst	1	12,800	Oil shale.
Do.	1	269	Antimony.
Mergui	1	384	Tin ore.
Do.	1	296·32	Tin and allied minerals.
Northern Shan States	2	348·16	Iron ore.
Pakokku	1	2,560	Natural petroleum.
Tavoy	1	144	Tin.
Do.	6	3,248·32	Tin and wolfram.
Do.	1	99·84	Cassiterite.
Do.	1	179·84	Cassiterite, wolframite and gold.
TOTAL	16		

TABLE 48.—*Prospecting Licenses and Mining Leases granted in the Central Provinces during the year 1925.*

DISTRICT.	1925.		
	No.	Area in acres.	Mineral.
Prospecting Licenses.			
Balaghat	185	18,705	Manganese.
Betul	1	530	Coal.
Bhandara	52	7,611	Manganese.
Bilaspur	3	277	Mica.
Do.	3	27,368	Coal.
Chanda	5	2,558	Do.
Chhindwara	12	3,103	Do.
Do	15	1,758	Manganese.
Drug	1	14	Galena.
Hoshangabad	2	276	Coal.
Jubbulpore	29	2,526	Manganese
Do.	1	22	Bauxite.
Mandla	2	100	Mica.
Do.	3	509	Copper, lead, mica, zinc and manganese.
Do.	1	99	Manganese.
Nagpur	89	10,675	Do.
Do.	1	802	Coal.
Seoni	2	294	Manganese.
Wardha	1	145	Do.
Do.	1	144	Copper.
TOTAL	409		
Mining Leases.			
Balaghat	33	1,821	Manganese.
Betul	1	105	Coal.
Bhandara	4	178	Manganese.
Chhindwara	2	162	Do.
Jubbulpore	4	64	Do.
Nagpur	10	344	Do.
Narsingpur	1	222	Copper.
Total	55		

TABLE 49.—*Prospecting Licenses and Mining Leases granted in Madras during the year 1925.*

DISTRICT.	1925.		
	No.	Area in acres.	Mineral.
Prospecting Licenses.			
Anantapur	1	22·25	Barytes.
Do.	1	1,616	Gold.
Bellary	7	5,844·64	Manganese.
Do.	1	200	Clay.
Cuddapah	1	30·51	Asbestos.
Do.	2	167·23	Barytes.
Kurnool	1	53·06	Iron ore.
Do.	2	10·0	Barytes.
Nellore	7	257·49	Mica.
Do.	1	54·79	Garnet.
Do.	1	15·03	
Salem	1	1,220·34	Iron, chromite and manganese.
The Nilgiris	2	519·08	Mica.
TOTAL	28		
Mining Leases.			
Anantapur	1	1,604	Gold.
Bellary	2	406·3	Manganese.
Cuddapah	1	6·94	White clay.
Kurnool	4	70·75	Barytes.
Do	1	46	Manganese.
Malabar	1	160	Gold
Nellore	10	760·87	Mica.
Salem	1	677·70	Corundum
The Nilgiris	1	46	Mica.
Total	22		

TABLE 50.—*Prospecting License granted in North-West Frontier Province during the year 1925.*

DISTRICT.	1925.		
	No.	Area in acres.	Mineral.
Prospecting License.			
Hazara	1	4	Coal. and carbonaceous clay.

TABLE 51.—*Prospecting Licenses and Mining Leases granted in the Punjab during the year 1925.*

DISTRICT.	1925.		
	No.	Area in acres.	Mineral.
Prospecting Licenses.			
Attock.	1	20·16	Mineral oil.
Jhelum	9	594·61	Coal.
Mianwali	1	1,792	Mineral oil.
Rawalpindi	1	2,816	Do.
Shahpur	1	7,040	Do.
TOTAL .	13		
Mining Leases.			
Jhelum	4	625·25	Coal.
Mianwali	1	455	Do.
TOTAL .	5		

THE METAMORPHIC ROCKS AND INTRUSIVE GRANITE OF CHHOTA UDEPUR STATE.

BY G. V. HOBSON, B.SC., A.R.S.M., D.I.C., *Assistant Superintendent, Geological Survey of India.* (With Plates 21 to 24.)

Introduction.

The metamorphic rocks in Chhota Udepur appear to be confined to the north-western corner of the State, covering the greater portion of the Kadwal ("Kadval") *taluk*. The granite is much more extensive, but this paper is confined to a description of an area of 152 square miles, including the whole of the Kadwal *taluk* and parts of the Jetpur and Tejgad *taluks*. This area is bounded on the north by the State boundary; on the west by a line running north from near the junction of the Orsang and Sukhi Rivers, to the hills south of Kadwal and thence west to the State boundary; by the Orsang River to the south; and by a line running north-west from Kasarmari, north of Chhota Udepur, to the boundary of the State north of Ghonta.

This area was surveyed by W. T. Blanford and the results published in 1869 in his memoir on "The Geology of the Taptee and Lower Narbudda Valleys."[1] Blanford describes most of the northern area of the State as consisting of a granitoid gneiss but in the north-western corner round "Kadval" he describes metamorphic rocks consisting of quartzites, conglomerates and slates, to which he gave the name Champaner beds, from the old town of Champaner (22° 29′: 73° 32′) in the Panch Mahals, formerly the capital of the Mahomedan kingdom of Gujarat.

Previous observers.

P. N. Bose covered the southern and eastern parts of the State, the results having been published in his memoir on "The Geology of the Lower Narbada Valley between Nimawar and Kawant."[2] The south-eastern corner of the area under report is covered by the latter memoir, in which however there is no detailed des-

[1] *Mem., Geol. Surv. Ind.*, Vol. VI, Pt. 3.
[2] *Mem., Geol. Surv Ind.*, Vol. XXI, Pt. 1.

cription of the gneiss, which the map shows to cover the whole stretch.

E. J. Beer in his paper entitled "Notes on the Rocks from Pavagarh to Dohad"[1] discusses the peculiar rock types occurring in what he aptly describes as the "retort-shaped hilly area" which lies south-west of Pavagarh Hill, the delivery pipe of the retort constituting the hill range south of Kadwal in the north-western corner of Chhota Udepur State. L. L. Fermor[2] visited the Champaner area in 1905 and was struck "by the extraordinary lithological similarity of the Champaner rocks to those of Jabalpur and their consequent probable Dharwar age." This is a presumption which the writer sees no reason to doubt.

Topography.

The topography of the area presents three aspects which are closely related to the geological formations. With the exception of the extreme north-western corner, constituting the Kadwal *taluk*, the area examined is granite country which presents to view a very characteristic topography. This may be described as closely resembling park land, for the most part flat, with streamlets running in shallow valleys and two main rivers, the Orsang and the Sukhi, flowing between low banks.

This park land is broken at intervals by typical hog-backed hills of granite ranging up to 500 to 600 feet above the general level and presenting characteristic curved surfaces due to weathering by exfoliation, or a tumbled heap of rounded boulders, or some combination of the two. In addition to these granite hills there are a few sharp peaks, such as Hill "1028" just south of Narvaina, five miles south-south-east of Kadwal, consisting of massive quartzite.

The second type of topography is that presented by the hill range of metamorphic rocks running in an easterly and westerly direction just south of Kadwal. Here the hills rise suddenly from the Kadwal plain, towering up to the peak of hill "1400," which is the highest point of a rampart-like quartzite ridge running like a wall for several miles, and broken only at four points where

[1] *Trans. Min. Geol. Inst. Ind.*, Vol. XIII, pp. 73-127.
[2] *Mem., Geol. Surv. Ind.*, Vol. XXXVII, pt. 2, pp. 281-2.

streams have cut gorges forming waterfalls and rapids. South of this there is an elevated plateau of very hilly country, built up of metamorphic rocks, descending more gently to the granite plain to the south.

The third type of topography is that of the Kadwal plain running north from the quartzite ridge above mentioned, as far as the State boundary. This area is marked by comparatively low hills of more or less uniform elevation with narrow valleys between. Some of the hills owe their preservation to quartz veins running through them; others are well rounded and in many cases are cultivated right over the top, in other cases they support scanty scrub jungle.

The south-western section of the area examined is drained by the Ani River and another unnamed tributary of the Orsang River, whilst the north-western and western sections are drained by the Sukhi River with an unnamed tributary flowing from the north-west out of Kadwal *taluk*. All these streams flow over wide sandy beds between low banks with occasional outcrops of rock breaking through the sand. They all cease to flow during the dry season but water is obtainable by sinking to no great depth in their sandy beds.

With the exception of scrub jungle on the hilly plateau south of Kadwal and on some of the hills north of that place there is no extensive forest growth in this area. The area between the Orsang and Sukhi rivers north of Jetpur is covered with a black cotton soil on which cotton is grown, but the remainder of the granite area has a light sandy soil which does not appear to be much cultivated. As already mentioned the soil in the phyllite area appears to be fertile, many of the hills there being cultivated right over their tops.

Geological Formations.

The geological formations of this area fall into two divisions, namely :—

(1) quartzites, schists and phyllites,
(2) granite or granitoid gneiss.

In addition there are certain intrusive dykes of younger age than the granite. The first of the above divisions constitutes the rocks known as the Champaner beds, of probable Dharwar age according to Fermor.

Granite or granitoid gneiss covers the whole area with the exception of the north-western corner and certain isolated patches of crystalline schist or gneiss, limestone and quartzite and a few intrusive dykes of trap. With only a minor exception to be described later the whole of the granite is remarkably constant in composition, the chief variation being in its texture.

Granite or granitoid gneiss.

In colour the granite is mainly greyish white owing to the felspars being mostly white, which colour is toned to grey, by the abundant biotite present, when the rock is viewed in bulk. A finer grained variety- 34/899 however, shows faintly pink owing to the colour of the felspars. The exception to the normal type of granite is 34/993 which is a fine-grained granite in which the felspars are pink and the resultant rock of a salmon-pink colour; microcline is absent. This specimen is from near Kasarmari, north of Chhota Udepur, and it is noticeable that the granite in this south-eastern corner is much pinker in colour and more gneissic in structure, than at Tejgad where it is massive and white in colour and has been quarried in places to provide stone for building the railway bridges.

Microscopically the granite varies from a greyish white to salmon pink colour and in texture from the finest microcrystalline up to a coarse granitic structure; in the latter type occur felspars up to 24 mm. by 9 mm. and flakes of biotite up to 4 mm. across, as seen in specimen 34/895. In the coarse varieties the rock consists of clear quartz, felspar and biotite in about equal proportions. The felspars are faintly pink, appear quite fresh and unaltered and can be seen to be twinned by the naked eye. Muscovite is almost absent, so that the rock is a biotite granite.

Microscopically the rock is seen to be a normal granite in which quartz, felspar and biotite predominate, with very subsidiary muscovite only in certain slides; traces of magnetite are observable in some cases. The felspars are but little altered and consist mainly of microcline and albite.

It is the writer's opinion that this granite or granitoid gneiss is intrusive into the Champaner beds and therefore post-Dharwar in age. The evidence on this point is not conclusive but the following points lead to this supposition.

For the most part the granite is devoid of any gneissic structure but in certain cases the rock near the boundary is markedly gneissic

and the direction of the foliation is parallel to the strike of the metamorphics. This is particularly well seen south-south-west of Dhanpur and to a lesser extent north-west of Hatipagla, on the east side of the *nala* south-west of Ghonta, south-east of Kundal, north-north-east of Motipura and against the quartzite on the west side of the ridge south-east of Kasarmari. This points to the conclusion that this marginal foliation was induced during the process of intrusion.

The general strike of the metamorphics is north-west and south-east but on the margin of the granite masses the schists can be seen bending round just as would be expected if the granite had forced its way up into them. Thus north-west and north of Raipur "Raypur" the metamorphics are seen to swing from N.W.-S.E. to N.E.-S.W., to E.-W. and again N.W.-S.E. round the granite boss of hill "1478."

The northern half of the Kadwal plain has innumerable quartz veins intruded into the phyllites and these are probably connected with the granite intrusion. Pegmatites are also found in certain places, intruded into the crystalline schists and, though it was not found possible to trace any of these into the granite, there is little doubt in the writer's mind that they are in fact connected with the last stages of the granitic intrusion. These pegmatites appear to be of no great size and are not of economic importance. They are found near the quartzite inlier west of Sihod. The metamorphics near Raipur are intruded by quartz veins carrying black tourmaline: the biotite gneiss of hill "1235" is traversed by pegmatites as are also the schists north of Kundal. Hill "819" is intruded by pegmatites which are also seen in the *nala* south-east of Kundal. The biotite gneiss of hill "952" and the inlier at Bijol are both intruded with pegmatite veins.

A glance at the map will show that the granite area is dotted with inliers or perhaps xenoliths of quartzite, schists, and limestones of the Champaner beds, these inliers or xenoliths being roof pendants of the original rocks into which the granite was intruded. That there are no traces of marginal metamorphism is not surprising, since the metamorphism of the Champaners was probably so complete as to be little affected by the subsequent granite intrusion. There are varying degrees of metamorphism in these beds but these variations appear to be due to greater compression and folding in certain areas rather than to the intrusion. Metamorphism has

been most complete near the Raipur granite boss where there are only crystalline schists with occurrences of quartz-epidote and quartz-epidote-garnet rock, whereas the phyllites round the granite boss of hill "1252" show little or no change from normal.

The most striking feature of the Champaner beds is unquestionably the quartzite forming ridge "1400" south of Kadwal. This quartzite is of varying thickness rising to 30-40 feet; there is another thinner bed a short distance to the north. The quartzite of hill "1400" dies out on the east at a point south of Vishengarh where it presents to view a mass of rock like the end of a ruined wall, rising sheer for some distance above the surrounding rocks and in marked contrast to the rounded contour of the granite hill "1478." From this point the quartzite runs south-west for a mile-and-a-half and then turns west-north-west for a mile; north-north-east of Kevra the bed makes a double right-angle bend and continues along its original direction but displaced to the north. At the point where this double bend occurs the quartzite has evidently been weakened by the flexion, and streams draining Kevra have broken through to the north-east forming a gorge through the quartzite. Plate 1, figur 1 shows a half end view of the quartzite on the western side of this gorge, taken from the north.

The Champaners.

The quartzite is then continuous to the valley south-east of Khandi, in which the main workings of the Pani manganese mine are situated; it is seen projecting into the east side of the valley but is here much thinner than in the gorge to the east. Here the quartzite loses its prominence and ceases to form the spine of the ridge, but there are indications that it continues across the valley and, after crossing the valley of the stream flowing from Itvada, appears to die out to the west. In Plate 1, figure 2, taken from the north-west, the quartzite is plainly seen entering the east side of the valley and there are indications of it on the knoll in the centre.

The ridge to the west still has quartzite bands, not of the same thickness, forming the spine, but these appear to be disconnected. It is possible that the beds were originally continuous. The valley south of Khandi was evidently the scene of considerable folding in a vertical plane, which has bent the manganese reef into the form of a much flattened S, whereby the general direction has been maintained but the western arm displaced to the south. The forces

which would bend the more or less flexible beds containing the reef, in this way, would be liable to fracture and crush the more brittle quartzite bed, this fractured portion being then more readily denuded away. This bending of the manganese reef is clearly shown by the line of opencast workings seen in Plate 1, figure 2.

These quartzite bands have all been tilted into an almost vertical position indicating considerable orogenic disturbance; at the eastern end of the Pani workings it was seen that the manganese reef had been thrown into a number of sharp overfolds which, while preserving a general high angle of dip, repeat the bed by the folding of a single original bed. This is indicated in Plate 2, figure 1, which shows a cross section of the reef repeated by overfolding.

The neighbourhood of the quartzite, particularly to the south, is the scene of the highest degree of metamorphism yet seen in the Champaner beds; it is only equalled by the area of considerable disturbance round Kundal and hill "849."

Immediately south of the quartzite is a thin bed of conglomerate the presence of which is indicated in a few places only and then mainly in the form of debris, the occurrence of the bed *in situ* being masked by debris from the quartzite spine. In the gorge south of Sarsuva on the western boundary of the State the conglomerate is seen as a narrow band *in situ* against the southern side of the quartzite band. Microscopically the specimen (34/928) resembles an autoclastic quartz conglomerate mainly consisting of fine material but containing one quartz pebble two inches long by an inch wide. Microscopically it is seen to consist of rounded and angular fragments of quartz in a finer mosaic of quartz with a little mica tending to wrap round the quartz grains; the writer thinks that it is a true conglomerate. In the gorge south of Undhania a very quartzose rock, resembling a metamorphosed conglomerate, was observed containing nodules of quartzite; no other occurrence at that time was observed. Again to the north-east of Kevra the conglomerate was seen almost *in situ* on the south side of the quartzite ridge. North-west of Raipur the bed could not be seen *in situ* but considerable debris is scattered on the slopes of which 34/978 is a piece; this has all the appearance of a true conglomerate.

In the gorge south of Sarsuva at the line of the southern band of quartzite, the stream-bed consists of a calcareous conglomerate evidently of recent origin. The writer thinks that this must be the

petrified waterfall described by E. J. Beer[1] at Poili, though this name cannot be located. The stream seems to have scoured out a deep pot-hole between the two quartzite bands occurring here and, when the limit of its excavating power was reached, the pebbles brought down were deposited in the cauldron and cemented in with calcareous matter derived from beds above. Finally the northern quartzite bed collapsed and was washed away, leaving a more or less cylindrical plug of calcareous conglomerate, the site of the present fall. This is doubtless being gradually undermined and broken off but a plug some 150 to 180 feet across and not less than 50 feet thick remains. The bed of the stream is also lined with similar material for some distance above the fall. The bed of the stream flowing past Bhabar is similarly covered for some distance with calcareous conglomerate, but there is here no fall.

South of the quartzite phyllite occurs, whilst further south this gives place to a calc-granulite forming a belt running eastwards and traced as far as the stream flowing to Bhabar, where, however, it has decreased very considerably in thickness. This is a dark grey rock in some bands of which occurs a mineral in very fine fans of radiating needles which glisten slightly and are evidently harder than the main mass of the rock as they tend to stand out on weathering (34/931); other bands have the same mineral occurring in haphazard needles (34/932). Microscopically the rock is seen to be made up of granular calcite with a colourless amphibole (tremolite). To the south this rock gives place to a pinkish friable limestone (34/934), also containing traces of tremolite and some quartz.

In the low ground here there is phyllite whilst the ridge near the boundary is made up of a gneiss (34/935) consisting mainly of clear bluish quartz in rounded grains in a groundmass of quartz, muscovite and biotite with a certain amount of tourmaline. One of the quartz grains has three idiomorphic crystals of tourmaline developed in it. On the south side the rock becomes much finer textured and of a reddish tinge, but retains the same constitution.

All these beds have an approximately east and west strike and dip at a very high angle, being in fact practically vertical. About a mile eastwards a similar sequence is observed. Starting from the

[1] *Trans Min. Geol Inst. Ind.*, Vol. XIII, p. 107, 1919.

quartzite of the ridge and proceeding south, there is first phyllite and then an area of mixed quartzites and limestones. Some of the former are hæmatite quartzite (34/940) whilst the latter contain green fibrous actinolite (34/949); one outcrop consists entirely of radiating fans of green actinolite, weathering brown, the calcareous matter having been apparently all weathered out. This gives place to white crystalline limestone with bands containing fibrous white tremolite in radiating fans (34/942). There are also bands of the grey calc-granulite. Just across the stream the phyllite is seen and extends to the top of the ridge where there is a belt of quartzite with the gneiss previously observed. In the stream-bed to the east is a waterfall produced by the belt of quartzite crossing the stream; much of this is a hæmatite quartzite (34/943) some 30-40 feet in width striking east and west and practically vertical. Below this is the phyllite which, near the junction of the streams in the valley below, gives place to the calc-granulite; here, however, it is quite a thin band.

The villages of Jhari, Kalikui and Bhabar, in the south-western corner of the Kadwal plain, all lie on a belt of very similar calc-granulite in which, however, there is a greater proportion of silica at the expense of the calcite and the amphibole is replaced by chlorite. This belt can be traced to the State boundary near Sarsuva and thins out in the stream-bed south of Khandi. It appears in the field as jagged outcrops of almost coal-black rock in which numerous veins of white quartz form a striking contrast. To the north the actual boundary of this bed with the phyllite is masked by alluvium, whilst to the south the rock passes by transition through a quartz-biotite-schist containing calcite, to the mica-schists and phyllite of the hill range.

This completes the description of the hill range to the south of Kadwal. The plain, from the foot of the range northwards for some two miles, is built up of phyllites or clay-slates of a greenish colour and rather soft. This area is much covered with alluvium and the rocks give rise to no striking topographical features. The streams run in comparatively deep courses cut through the mantle of alluvium into the soft phyllites.

The northern portion of the Kadwal plain right up to the State boundary presents, however, a different aspect. Here the surface consists of small hog-backed hills of no great elevation and of more or less uniform height, the majority of which owe their existence

to a spine consisting of quartz veins or thin beds of quartzite, the remainder of the hill being the normal phyllite.

The strike in this area is between W.N.W.-E.S.E., and E.-W. with the exception of the eastern side where the strike of the phyllites can be plainly seen curving round the granite mass of hills "1462," "1252" and "1386." The dip is always at a very high angles, sometimes one way and sometimes the other. Whilst engaged on this work the writer took this dip and strike as being that of the original bedding and it was only in the course of the last day's work that slight evidence was found tending to upset this idea.

Whilst travelling down the valley between Amadara Nana and Amadara Mota it was observed that the expanse of rock from the Kadwal hills to the State boundary may, possibly, be not a simple sequence of clay slates and quartzites but a repetition of the rocks by overfolding, with the same general dip, though with minor variations, but always a very high angle. Furthermore, north-west of Jogpura there is a speckled quartzite (34/913) which is repeated at an interval of about half-a-mile to the north. On the last day in this area a small exposure of rock was found just where the stream crosses the State boundary north-west of Khand, in which bands of varying colour were observed in the slates, making a distinct angle with the cleavage. These bands are due to the greater development of biotite in the darker bands due to difference of composition in the original rock; hence these bands mark the original bedding. Additional evidence on this point is necessary but the writer is inclined to the theory that this area is covered by rocks which have been thrown into very sharp folds or even overfolded, and that these tectonic movements have induced a cleavage in the rocks at an angle to the direction of pressure. Hence this cleavage is, for the most part, parallel to the original strike and dip where the beds have been tilted at high angles but at the anticlines and synclines the cleavage makes a variable angle with the original bedding and it is this that was observed near Khand.

Prior to leaving Chhota Udepur City the writer was informed that galena occurred in the Kadwal *taluk* and on arrival an effort was made to locate the mineral. The occurrence was finally located on a small hill about one mile north-west of Jogpura. As is so often the case this hill has a spine consisting

of a vein of quartz and in the soil round this the galena is found in loose lumps much of which consists of cerussite. In the short time available a certain amount of surface scratching was done but the mineral was not located *in situ* (see page 354).

The mixed phyllites and schists of the Champaner series continue in an east-south-easterly direction where hill "849" and the country surrounding it consists of the more highly metamorphosed rocks of the series, namely mica schists with numerous quartzite bands and at least one belt of calc-gneiss. Hill "952" to the south consists of biotite-gneiss similar to that observed all round the granite boundary from north-west of Raipur, round hill "1478."

In the village of Chetapur Chaena there are two thin bands of white limestone in the prevailing phyllites and here a black earthy material was found which proved to be wad (see page 351).

The granite appears to cut off entirely the metamorphic rocks, but there are two points where this is doubtful. The first is in the stream running north-east to Dungarbhint. About one mile east of Kundal the granite was observed both north and south of the stream but in the valley no rock exposures were found; pending examination further east of this point the boundary here must be left in some doubt. The other doubtful point is the Sukhi River valley south-east of hill "952," which is again alluvium-covered. Granite is seen in the villages of Dungarvant and Kirkavada and again in the fork of the river and the hill north-west of Sagdhara but not between. To the south-east, however, hill "1102" is composed of granite but hill "1235" is biotite-gneiss, with granite to the north of it again. It seems, therefore, a reasonable supposition that the biotite-gneiss stretches across from hill "952" to hill "1235," this being the direction of strike, and it is accordingly so marked on the map, but the possibility must not be overlooked that the granite actually comes up between and is masked, in which case hill "1235" would be an outlier of Champaners.

With the exception of numerous other small outliers of schist, quartzite and limestone, the rest of the area examined consists of granite, which has already been described.

There is a long narrow outcrop of limestone running roughly east and west lying just south of hill "1122" to the north-east of Malu. At the western end this is of a green colour, weathering almost white inside, though nearly black on the outside (34/988). Microscopically the rock is seen to consist of granular calcite with

serpentine, which latter by alteration is becoming opalised; it is evidently this opalisation which results in the white colour of the weathered rock.

Limestone also occurs just west of the village of Malu and a white crystalline limestone or marble is found on the road from Tejgad to Chhota Udepur at the village of Dhandora. Outliers of biotite gneiss occur at Bijol and Chilarwat and indicate a general continuation of the belt forming hills "952" and "1235" to the north-west. There are also numerous roof pendants of quartzite similar to those seen at the western end of the area examined.

The youngest rock formation of the district consists of small dolerite dykes which have been intruded through the granite. Five of these have been observed, the largest being about half-a-mile north of Gelwat and traceable for half-a-mile, making a gradual curve from a northerly to a north-easterly direction. The dyke is of no great thickness, though wider than any of the others.

Intrusive dykes.

Similar dyke-material may be seen penetrating the granite just against the south side of the road bridge west of Gelwat. (It should be noted that the present alignment of the road from Chhota Udepur to Dhandora lies somewhat north of the line marked on the map.). Here the trap is seen penetrating the granite on which the bridge is founded, as a dyke 35 feet wide with a second 20-foot dyke to the south and 45 feet of granite between them, with trap overlying it. The whole is overlain by alluvium which comes down on the south side masking the trap which may or may not be wider than the 20 feet observed. The whole mass here is very rotten and weathered but the occurrence can be clearly seen and this is the only instance of anything in the nature of a lateral flow of the trap which was observed. North of the bridge there is another small dyke penetrating the granite. The third occurrence is just north-west of Kasarmari where the line of a thin trap dyke, running approximately N. N. E.- S. S. W. is marked by surface boulders. This can only be traced for quite a short distance each way. The fourth occurrence is a small dyke running almost due east and west in the stream-course just south of Khajuria. The fifth and last occurrence was observed just south of the defile between hill "922," south-east of Malu, and the hills running south-east. This is quite a narrow dyke which is shown mainly by rounded boulders on the surface. The dyke runs due

east and west and was traced for about half-a-mile. At only two points was anything in the nature of a section observed, where two small streams had cut slightly into the trap and the adjacent granite. Actual contact specimens were obtained here (34/984, 34/985, 31/986, and 34/987) and these show that the dolerite has been intruded into a somewhat crushed granite. with the production of a hybrid rock. Fine needles of felspar have been developed in the granite, occurring as radiating fringes round the original felspar crystals and with the same optical orientation (see Plate 3, figs. 1 and 2).

Economic Geology.

Manganese.

Manganese is easily the most important mineral of economic value occurring in the area under examination. As already mentioned the manganese reef occurs on the north side of the hill range south of Kadwal, lying quite close to the quartzite spine of ridge "1,400". Just prior to the European war of 1911-18 the property was worked by a German firm and after the outbreak of hostilities it passed under the control of the Shivrajpur Syndicate, managed by Messrs. Killick, Nixon & Co. of Bombay, who took over the property on the understanding that no concession to work any minerals should be granted within a radius of six miles from Pani.

Up to the present the entire work has been done by opencast with the result that a great gash has been cut along the hillside, as may be seen in Plate 1, figure 2, and most of the evidence as to the original formation has been destroyed. The workings, however, clearly show the acute fold by which the reef has been turned back on itself for some 300 to 400 feet and then back again parallel to the original direction but displaced to the south. Evidence of the original width is lacking but the width now varies from a few feet up to forty feet, the reef being almost vertical with perhaps a slight tendency towards a dip to the north. The ore appears to be the result of the replacement, more or less complete, of quartzite by oxides of manganese. Sporadic occurrences of very high grade pyrolusite are found from time to time, yielding ore containing as much as 95 per cent. of pyrolusite and more (M. 781).

In addition to the main fold about the centre of the workings mention has been made of minor folding at what was the extreme eastern end of the workings at the time of examination. Some

distance west of this point, what appeared to have been a trial pit had been sunk and then cut open from the front, and in this the folding could also be seen. Here the reef consists of clayey wad-like material mixed with quartzite in all stages of conversion into manganese ore and having a four-inch selvage of unaltered, reddish-brown quartzite on each side. Some of this quartzite shows dendritic markings 31/953). On the outer side the reef rests against phyllite, and the apex of a fold is just seen with its upper limb running across the back of the pit. There is a white clayey rock between, which is a decomposed phyllite (34/952). This rock also overlies the top arm of the fold with another section of the reef crossing the pit just under the surface debris. The top limb is just visible in Plate 2, figure 2, with the intervening phyllite below and the centre limb of the reef with its quartzite selvage clearly seen in the centre of the photograph and the fold and lower limb of the reef on the right. The photograph had to be taken at an awkward angle and under bad lighting conditions but with the aid of the sketch, Plate 3, figure 3, it becomes fairly clear.

Comparatively little work was being done at this eastern end, the chief effort being confined to the section on the main fold and the westward extension just started and seen on the extreme right of Plate 1, figure 2. The reef has in places been worked out to a depth of from 40 to 50 feet and the floor has thus been brought down to plain level and even a little below so that drainage ceases to be natural. Furthermore, trouble is now likely to be experienced from the weight on the back wall due to the ridge behind. This wall is much higher than the front owing to the steep slope of the ridge, as can be seen in Plate 1, figure 2, and it is cut on the dip, which is very steep or practically vertical. To reduce the weight on this back wall would involve the removal of an impossible amount of waste, and opencast working has in many places reached its limit.

There is evidence, in the shape of old workings, showing that the reef extends westwards to beyond the stream south-west of Khandi and the writer was informed that it had been found more or less continuous right along to Shivrajpur. On the eastern side there is a knoll at the end of ridge "1,400" south of Vishengarh, consisting of quartz-tourmaline rock in which there are signs of old pits and trenches which were said to have been dug for manganese, without success.

As already mentioned manganese was found to occur at the village of Chetapur Chaena some six miles east-south-east of the Pani workings. It seems quite possible that this is an easterly extension of the same reef, or perhaps an easterly detached occurrence on the same strike, if the deposits here prove to be in the form of detached lenticles. No evidence of manganese was found between these points or further eastwards.

A monorail was originally built from Champaner Road, on the Bombay, Baroda and Central India Railway main line, to Shivrajpur, to take out the manganese ore from that place. This line was subsequently replaced by a metre-gauge line which was later extended to Pani to tap the manganese deposit in that area. Hence the railway development of this part of the State is due to the occurrence of payable manganese.

Lead.

Another metallic mineral found to occur in the area examined is the galena previously mentioned, located on a hill north-west of Jogpura This was the only occurrence actually seen, but as galena is generally reported from Borkunda it seems quite possible that a detailed search might reveal other deposits, though several other reputed occurrences were sought without success. The galena appears to be associated with the quartz vein, though this was not actually proved, and the whole of the northern part of the Kundal plain is riddled with such veins. A sample of the material collected was assayed for silver; the results showed 76 per cent. Pb, which would of course be low, being a pot assay result, and silver in the proportion of 24 oz. 4 cwts. 3 grs. per long ton, which may be taken as correct.

Iron.

Iron in the form of haematitic quartzite occurs in the hill range south of Kadwal, on both sides of the central valley. A quartz vein crossing the stream flowing out from Itvada also carries specular iron ore. None of these occurrences are of economic value owing to the difficult country in which they occur, the smallness of the deposit and its distance from any smelting area.

Limestone.

Turning now to the non-metallic minerals of economic importance, the crystalline limestones occurring as outliers in the granite are worthy of attention. The outlier near hill "1122," north-east of Malu, consists of a serpentine marble of an oily leek-green colour; it is of a compara-

tively fine texture, will take a good polish and should make a very handsome ornamental stone for interior decoration.

White marble has been used in the construction of the new palace in Chhota Udepur. This was brought from a point near Jamla, north-north-east of the city, but the locality has not yet been examined. Similar material occurs just across the Orsang River south of the city, where it is used for lime burning. This also is outside the examined area but the limestone found at Dandora is the same.

The calc-granulite from the central valley of the Kadwal hill range is very fine textured and the radiating fans and needles of amphibole lend a sort of pattern to the stone. The stone is dark grey in colour. It should make a useful building stone for certain purposes but would probably prove to be less easy to cut, dress and polish than ordinary marble owing to the amphibole in it; it also occurs in rather inaccessible country.

The calc-granulite occurring north of the hill range has been used in the past for lime-burning; it would probably make an indifferent lime owing to the admixture of chlorite and quartz which freely occur. The quartz in the stone would also make it a hard rock to cut and dress for building purposes.

Lime-burning is carried out at Khandi, near Pani Railway Station, the raw material being *kankar* carted from Borkunda.

Kankar.

This *kankar* has evidently resulted from the decomposition of the metamorphic rocks and has been concentrated in patches and pockets along the stream-course in Borkunda, whence it is being dug out and carted to Khandi. The presence of these lime kilns located almost on the calc-granulite and yet using *kankar* from five or six miles away indicates that the material got by burning the calc-granulite was at any rate not good enough for sale in the open market.

In the stream-bed south of Kundal a series of calcareous rocks is exposed, one of which is a calcareous graphitic schist crossing the stream-bed as a black band. The band is quite thin and the schist is not sufficiently rich in graphite to be of any economic value, as far as the exposure examined is concerned.

Graphite.

The pegmatites of hill "952" were reported as yielding mica up to four inches square but though some of them looked somewhat promising nothing approaching this size was found.

Mica.

Granite.

Much of the granite in the area examined would make very excellent building stone, particularly certain of the medium and finer textured varieties. Some of this granite has in fact been quarried from near hill "1325" at Tejgad and certain other places and used in the construction of bridges on the railway line to Chhota Udepur. Beyond this there appears to be but little local demand for the stone and for export purposes transport charges would probably be prohibitive.

Road-metal.

The favourite material for road-metal in the area appears to be the quartzite from the various inliers. The stone is hard and might for this reason be thought good for road-metal, but although hard, it is brittle and under load and impact it breaks up readily and is ground to a fine white dust; it is in fact poor material for roads.

The granite of the area would make a fairly satisfactory road-metal if care were taken to employ only the finest textured material. Even this would not make a really first-class road-metal. Unquestionably the best material available is the dolerite of the dykes already mentioned. This is a very fine-textured rock, and is extremely tough and resistant to wear. In using this rock, however, weathered-out boulders should be rejected as such material is always to some extent superficially rotten. Freshly quarried stone broken into angular fragments will make the best metal both for binding in the road and for wear.

Water

All the water-courses in the area examined were already dry when the district was reached early in February and the only surface supply of water observed was a large tank on the river bank at Jetpur.

The soil is for the most part readily porous to surface water, which finds its way down to but a little depth. Thus comparatively shallow seepage wells are found to yield quite good supplies of water and even as late as May, after an exceptionally hot and dry season, shallow holes in stream-beds were still yielding water supplies for whole villages.

In the area examined the only important site with regard to water questions, is the elevated plateau south of Kundal. Here there occur three small catchment areas drained by the streams flowing out through narrow gorges south of Bhabar, south-west of Khandi and south of Undhania. Owing to the narrowness of the gorges the areas could be impounded by the building of quite small dams and the rock foundations would be suitable in every way.

EXPLANATION OF PLATES.

PLATE 21, FIG. 1.—Western end of Quartzite Ridge in the gorge south of Undhania.

,, FIG. 2.—General view of the Pani Mine from the north-west.

PLATE 22, FIG. 1.—Folding of Manganese Reef at the eastern end of the Pani Mine.

,, FIG. 2.—Folding of Manganese Reef near the eastern end of the Pani Mine.

PLATE 23, FIG. 1.—Photomicrograph of granite-dolerite hybrid rock showing aggregates of secondary felspar needles in the S. W. quadrant and secondary felspar fringes round original crystals in the centre and N. E. quadrant.

,, FIG. 2.—Same as Figure 1, but with nicols crossed showing secondary felspar fringes in optical continuity with original felspar.

,, FIG. 3.—Sketch section of the manganese reef at the eastern end of the Pani Mine.

PLATE 24.—Geological Map of Chhota Udepur State; scale 1 inch=1 mile.

APPENDIX

Place.	Latitude..			Longitude.[1]		
	°	′	″	°	′	″
Bhabar	22	28	40	73	49	00
Bijol	22	22	50	74	1	00
Borkunda	22	32	40	73	49	30
Chetapur Chaena	22	27	00	73	55	50
Chilarwat	22	21	40	74	2	20
Chhota Udepur	22	18	00	74	4	20
Dhandora	22	19	10	74	1	10
Dhanpur	22	27	40	73	54	50
Dungarvant	22	25	40	73	55	40
Gelwat	22	18	20	74	2	30
Ghonta	22	29	30	73	56	40
Hatipagla	22	25	40	73	52	20
Itvada	22	27	30	73	49	50
Jamla	22	21	00	74	5	40
Jetpur	22	20	30	73	54	10
Jhari	22	28	30	73	47	50
Jogpura	22	31	50	73	51	30
Kadwal	22	29	40	73	49	20
Kand	22	32	10	73	49	00
Kasarmari	22	21	40	73	4	00
Kevra	22	26	50	73	52	00
Khajuria	22	20	30	74	0	50
Khandi	22	28	40	73	50	20
Kakavada	22	25	10	73	56	10
Kundal	22	27	50	73	57	20
Malu	22	24	20	73	58	30
Pani	22	28	40	73	51	20
Raipur	22	25	50	73	53	30
Sagdhara	22	25	50	73	56	30
Sarsuva	22	28	30	73	47	10
Sihod	22	19	20	73	52	10
Tejgad	22	20	40	73	58	00
Undhania	22	28	40	73	51	00
Vishengarh	22	28	10	73	54	10

[1]These longitude readings are those of the old map and require correcting by the addition of 2′ 27″.

REMARKS ON THE KNOWN INDIAN SPECIES OF CONOCLYPEUS, WITH DESCRIPTIONS OF TWO NEW SPECIES FROM THE EOCENE OF NORTH-WEST INDIA. BY MAJOR L. M. DAVIES, R. A. (With Plates 25 to 26.)

It does not seem that any Indian species of *Conoclypeus* has ever yet been identified with an European one. In 1889-94 Cotteau recognised three French species and eighteen foreign to France[1]; among the latter he admitted, as distinct from each other and from the rest of the then known types, the six Indian species described by Duncan and Sladen.[2] It is worth remarking that Cotteau rejected the earlier described *C. flemingi* of d'Archiac, owing to the indeterminate character of the specimen upon which the species was founded, of which the genus itself is uncertain[3]. It appears, from the figure given in d'Archiac and Haime's own work,[4] that this caution is well justified.

Since Cotteau wrote his comments, a number of new species of *Conoclypeus* have been described in other countries (though no more in India), and we have probably now to recognise about 40 species instead of the 21 of Cotteau. It does not seem, however, that any European or other western specimen has yet been found which exactly corresponds to an Indian one.[5] On the other hand, the Indian specimens seem to form a fairly closely related group among themselves, to which the two new species now about to be described also appear to belong, without being actually identifiable with any of the forms already known. As I have recently been given, through the courtesy of the Director of the Geological Survey of India, the fullest opportunity of examining the original specimens

[1] "Echinides Eocènes" by G. Cotteau, *Palæontologie Française*, 1-re Serie, Vol. II, p. 196, ff.

[2] *Pal. Ind.*, Ser. XIV, Vol. I, Memoir 3, Fas. II and III.

[3] *Op. cit.*, pp. 214-215.

[4] *Ann. Foss. du Groupe Numm. de l'Inde*, 1853, p. 215 and Pl. XV, fig. 1.

[5] The western forms which approach the Indian types most closely seem to be *C. delanouei* P. de Loriol, 1880, from the Eocene of Egypt, *C. vilanovæ* Cotteau, 1890, from the Middle Eocene of Spain, and *C. pyrenaicus* Cotteau, 1856, from the Middle Eocene of France and Spain.

from which Messrs. Duncan and Sladen described their species, I am in a position to describe the new types with some confidence in regard, at least, to their differences from those which approach them most closely.

CONOCLYPEUS PILGRIMI, sp. nov.

Plate 25, figs. 1—6, Plate 26, figs. 1 and 2.

General remarks.

This form appears in considerable numbers in a particular limited zone of the Eocene rocks of Kohat (33° 35′ 30″; 71° 30′ to 71° 33′), and its chief interest lies in the fact that it is the first Indian type of its genus to be described from a large number of fairly well preserved specimens, collected within a small area, at an exactly definable stratigraphic horizon. Not only, therefore, can all its main characters be ascertained with certainty, but the general constancy to type of the specimens, together with the impossibility of separating them into more than one species, allows one both to judge of the characters which seem to be variable, and also to refer with some confidence even to comparatively minor details of form, where these seem to belong to the type rather than to the individual. The new type thus markedly differs from those Indian species (*i.e.*, *sindensis*, *declivis*, *galerus*[1] and *rostratus*) in which one or more features – apical system, periproct or peristome – are totally unknown, and which have sometimes also been obviously distorted in shape by rock pressure. Even the holotypes of *pinguis* and *alveolatus*, which are really beautiful and almost perfect specimens, seem to stand alone as representatives of their species; so it is not certain to what degree their minor characters are specific rather than individual. In other words, *C. pinguis* and *C. alveolatus* are at present the only two really well defined Indian species of this genus; the new species makes a third, with the added advantages of being represented by a fairly large number of specimens and coming from an exactly definable stratigraphic zone.

[1] Cotteau renamed this species *C. duncani*, to avoid confusion with *C. galerus* Schafhautl, 1863. Presumably *duncani* is therefore its correct name. As I am referring only to Indian species in the body of this paper, however, I am retaining the more familiar Indian name for the type. My references therefore are to *C. galerus* D. & S., 1884, non Schafhautl, 1863.

Description of species.

The test is large, about 130 mm. long, and subconical, its height being about 54 per cent. of its length.[1] Its apex is slightly (or about 4 per cent. of its length) excentric to the front, and the dorsal outlines descend from apex to ambitus in regular curves, the anterior curve being more convex than the posterior, but less so than those to the sides. The ambital margin is somewhat tumid in front, less so at the sides, and comparatively sharp in the rear.

The actinal surface is concave, and sub-oval in shape. Its greatest width is opposite the extremities of the anterior lateral petals, or about 15 per cent. excentric to the front, and equals about 80 per cent. of its length. The average concavity of the base, as measured in twelve specimens, equals 10 per cent. of the height of the test. This concavity, however, though always present, is apt to vary. Most specimens show a concavity of from 8 to 12 per cent. of their height, but in one it is only 2 per cent., and in another as much as 17 per cent.

The apical plate is pentagonal in shape, with four large genital pores at the four anterior angles, and a somewhat pronounced tongue at the imperforate and posterior fifth. The whole plate is punctured with madreporite pores, with the exception of a narrow imperforate rim (not always distinguishable) round each genital pore. The ocular pores are small, and the ocular plates impinge slightly upon the sides of the apical plate.

The ambulacral petals[2] are wide, and slightly and evenly sunken through the greater part of their length. The anterior petal is straight; the anterior laterals curve slightly forwards; the posterior laterals are slightly and gracefully sinuous, curving outwards somewhat sharply for the first third of their course, rather less sharply through the middle third, and again inclining more outwardly for the last third. They terminate well above the ambitus (about $1\frac{1}{2}$ cm. above it in the adult).

The poriferous zones are broad; their breadth increases somewhat rapidly for a short distance from the oculars, then more gra-

[1] This represents the average height of 12 specimens. Height seems to vary considerably in this species, being as little as 50 per cent. in some and as much as 58 per cent. in others, with every gradation in between. The figured specimen is higher than the average.

[2] I use the term "petal", for convenience, to denote the portion of the ambulacrum supplied with conjugate double pores, whether the end of the same is constricted or not.

dually for the rest of the first third of the length of the petal, after which it remains constant through the middle third, and decreases again gradually through the lower third. The petal is finally terminated in somewhat abrupt fashion, the outer pores in the last 3 or 4 pairs separating from each other and approaching their respective inner pores, so that the groove joining the last pair is only about $\frac{1}{3}$ to $\frac{1}{4}$ as long as the grooves in the middle of the petal, and is inclined at about 30° to 60° to the ambitus. A single row of pores continues from the end of the petal to the peristome, at each margin of the amb. As the latter nears the peristome, a narrow but widening and deepening granular border appears at each of its margins. Within this border the pores become first crowded and irregular, and finally appear to be regularly doubled, the outer ones being slightly larger than the inner.

The pairs of pores in the ambulacral petals are numerous, the outer pores being longer than the inner. The grooves joining them are deep, and all but the last few are straight and lie parallel to the ambitus. The costae between the grooves are ornamented with closely packed granules, not disposed in even rows as with some other species.

The interporiferous zones are about four-fifths of the width of the poriferous areas in the middle third of the petal, and widen by about another fifth towards the end of the petal, as the poriferous areas contract. Their ornamentation is crowded, uniform with that of the inter-radial areas, and consists of the usual small, equal, perforate and crenulate tubercles, sunken in aureoles.

On the actinal surface the anterior amb is seen to be straight, while the anterior laterals are slightly convex, and the posterior laterals markedly concave, to the front. On approaching the peristome the whole ambulacrum sinks, troughwise, between the adjacent inter-radial areas, and assumes a convex surface owing to the deepening and widening of the granular borders mentioned above.

The inter-radial areas of the abactinal surface are slightly tumid at their junctions with the ambs, but smooth and somewhat flat between, with an inclination to slight depression at the median line[1].

[1] In these respects *C. pilgrimi* differs from all the types figured by Duncan and Sladen, since the latter either have more rounded inter-radial areas (*sindensis, declivis*, sp., *galerus, rostratus* and *alveolatus*), less tumid margins (*pinguis* and *galerus*), or posterior ridge (*sindensis galerus, rostratus, pinguis* and *alveolatus*).

The peristome is central or sub-central, pentagonal, transversely broad.

The periproct is ovate, elongate longitudinally, with the smaller end towards the peristome. In the largest specimens its elongation is very marked, and its position is close to the ambital area, which it touches but does not transgress. In the smallest and presumably least mature specimens, however, the periproct is markedly shorter and rounder, and partly situated *on* the ambitus, its plane being inclined to the actinal surface. Intermediate stages, in shape and position, are found in specimens of intermediate size.[1]

Taxial position of species.

The specimens were found in considerable numbers, about 4 to 6 miles east of Kohat, in beds composed of limestone bands with stiff yellow calcareous clay partings. The position of these beds suggests their correlation with the mid-Laki "Alveolina Limestone" of Sind. Thus they are underlain by a considerable thickness of clay beds which appear to correspond to the Lower Laki "Meting Shales," since local traces of vegetable remains are found at that level, and they are overlain by some 600 feet of beds with a Laki fauna on top, which seem to correspond to the "Ghazij Shales" etc., of Upper Laki levels.[2]

The fauna of the limestones themselves also bears out their mid-Laki character. Thus they not only contain such typical Laki foraminifera as *Nummulites atacicus* and *Assilina granulosa*, besides many Laki molluscs, but they are crowded with *Alveolina oblonga* together with *Orbitolites complanatus*, a typical "Alveolina Limestone" combination as found in Sind [3] and Southern Tibet.[4] *Hemiaster apicalis* D. & S., said by Vredenburg to "characterise" the Alveolina Limestone of Sind,[5] has also been found in these limestones.

[1] A similar movement of the periproct, away from the apex and towards the peristome, has been recorded and figured by A. Agassiz, when describing the development of *Brissopsis lyrifera* and *Echinarachnius parma* (see Plates XIX. f. 1, 4, and XII f. 1, 4, 9, etc., in his *Revision of the Echini*. Pt. IV, *Structure and Embryology of the Echini*, in *Memoirs of the Museum of Comparative Zoology*, Harvard, Vol III, p. 744, etc.)

[2] Discussed in detail in my "Notes on the Geology of Kohat," published in Vol. XX, *Journ. As. Soc. Bengal.*

[3] Thus Geological Survey of India specimens No. G. 280-115 and G. 280-77 (*b*), from the Alveolina Limestone of Sind, closely resemble specimens from this horizon at Kohat.

[4] C. *Pal Ind.*, New Ser., Vol. V, Mem. 3, pp. 42, ff., and Pl. XVI. In his notes for a Memoir on Indian Alveolines, which he was preparing at the time of his death, Mr. Vredenburg stated that these forms were collected from the Alveolina Limestone of Southern Tibet.

[5] *Rec. Geol Surv. Ind.*, Vol. XXXIV, p. 193.

It seems therefore that this *Conoclypeus* belongs to the mid-Laki "Alveolina Limestone" zone. It is thus approximately associated with *C. alveolatus*, the only other member of the genus to have been reported as yet from the Laki; although the zonal placing of *alveolatus*, within the Laki, does not seem to be so exactly known.

I am taking the liberty of naming this species after Dr. Pilgrim, of the Geological Survey of India, who was the first to suggest my studying the geology of Kohat.

CONOCLYPEUS WARTHI, sp. nov.

Plate 26, figs. 3—6.

General remarks.

Only one specimen is known of this form. It was collected some years ago by Mr. H. Warth, late of the Geological Survey of India, from the vicinity of Jutana (32° 43½′; 73° 9½′). The stratigraphic horizon from which it came is not recorded. Although it stands alone, however, the specimen is so strongly marked in every way that it seems undoubtedly to constitute a perfectly distinct species, and the Director of the Geological Survey has kindly permitted me to describe it.

Description of species.

The test is large, bigger even than a full-grown *C. pilgrimi*. Its dimensions are: length, 144 mm.; breadth, 109 mm.; height 78 mm. The apex is 78 mm. from the posterior end of the test, or about 5 per cent. excentric to the front. The peristome, so far as one can judge from the converging ambs on the actinal surface, should be about 82 mm. from the posterior end of the test, thus being even more excentric forward than the apex, a singular feature for this genus.

The base of the test is semicircular in front of the peristome, and pointed behind, thus being more or less kite-shaped.

In side elevation the test is very tumid, and higher behind the apex than in front. The anterior profile runs almost directly forward from the apex, with a descent of only ¼th of the height in ¾ths of the distance from apex to anterior margin; after which the profile curves rapidly over and descends almost vertically for the next two quarters of the height, and then swings round in a semicircle, downwards and to the rear, for the last quarter. The anterior ambitus is thus very rounded and tumid, unlike any other Indian species. To rear of the apex, the profile rises slightly for ⅓rd of the

distance to the posterior margin, then swings round and downwards in a broad curve, and finishes with the last 1 cm. of the profile as a straight line descending at over 70° to the ambitus. Thus the rear portion of the ambitus is almost rectangular in profile, and in marked contrast to its very rounded shape in front.

The cross elevation of the test is also peculiar, as the lines of the profile go out horizontally from the apex for at least $\frac{1}{2}$ the distances to the sides, then swing round in bold convex curves and finally descend, for the lower half of the total height, in vertical or even recurved lines; so that the top of the shell appears to be quite flat, as seen from the rear (or front), and overhangs the ambitus on both sides.

Thus the appearance of the test as seen from beneath, from the side, or from either end, is most unusual, and quite unlike that of any other known Indian species of this genus.

The ambulacral petals terminate far (at least 2 cm.) above the ambitus, and the petal ends are of the usual Indian type, though slightly more tapered and with the terminal conjugate grooves slightly more horizontal than in *C. pilgrimi*. The poriferous areas are very broad: for the first half of the petal length they are about twice as broad as the interporiferous areas. At the ends of the petals, however, the interporiferous areas become nearly as broad as the poriferous at their widest. The poriferous areas exhibit much the same general plan of increase and decrease in width as is found in *C. pilgrimi*, but the terminal portion is rather more tapered.

The interambulacral areas are striking in appearance, representing a great exaggeration of tendencies only faintly indicated in *C. pilgrimi*. Thus the petals, as with that species, are sunk evenly between the interambulacrals for at least three quarters of their length, but they are sunk far more deeply. The interambulacrals are also far more tumid at their junctions with the ambs, and the tendency to central depression, noted in *pilgrimi*, is here so exaggerated that distinct median grooves appear, giving a singular appearance to the test.

There is also a similar, but much slighter, median depression in the interporiferous areas of the ambs.

The ornamentation of the test is of the usual pattern, but the test is too weathered for details to be seen, *e.g.*, on the costæ between the conjugating grooves of pore-pairs. All one can say is that the

ornamentation, though close, is not quite so closely packed as in *C. pilgrimi.*

The details of the apical disc are unfortunately indistinguishable; the whole region of the peristome has been destroyed, so that no details can be recorded there.

The periproct is ovate, elongated longitudinally, with narrow end towards the peristome. It is situated close up to the ambitus. Its shape and position are thus much as in *C. pilgrimi,* but it is distinctly smaller (14 by 10 mm. instead of 18 by 11 mm; even a *C. pilgrimi* only 115 mm. long has a periproct 15 by 10 mm. in size).

It is impossible to say exactly what the character of the actinal surface of this test may have been, as so much of its central portion has been destroyed. It was probably slightly concave.

Taxial position of species.

The Indian species of *Conoclypeus*, including the two new ones here described, have a family resemblance in the uniformly excentric positions of their apical discs, in the great width (even exaggerated in *rostratus*) of the poriferous as compared with the interporiferous portions of their ambulacral areas, and in the nature of the conjugating grooves of their pore pairs, these being uniformly horizontal (*i.e.*, parallel to the ambitus) instead of being curved as in the figures of so many western types. The petals also always end well above the margin, and except in *alveolatus*- abruptly; they are also invariably equal o. sub-equal in each pair.

There is, however, an apparent tendency in these Indian types to modify certain details in successive zones [1]:

(*a*) Thus, if we examine the proportion of petal width -measured, for uniformity, in the middle of the petal—to total length of the test, we find it to be as follows:

Ranikot.	Laki.	Khirthar.
10·4 per cent., *sindensis*	14·5 per cent., *alveolatus* .	16·5 per cent., *pinguis.*
9·9 per cent., sp. .	15·0 per cent., *pilgrimi* .	14·6 per cent., *rostratus.*
12·3 per cent., *declivis* . .	....	15·6 per cent., *galerus.*

[1] I follow the stratigraphic placing of Duncan and Sladen's species as given by Vredenburg, *Rec., Geol. Surv. Ind.,* Vol. XXXIV, pp. 187, 188, 190 and 194.

(*b*) Measuring the lengths of anterior, and posterior lateral, petals, we find the latter to exceed by the following proportions :—

Ranikot.	Laki.	Khirthar.
17 per cent., *sindensis* . .	16 per cent., *alveolatus* .	11 per cent., *pinguis.*
	13 per cent., *pilgrimi* .	5 per cent., *rostratus.*
		8 per cent., *galerus.*

(*c*) The relative heights of the tests, in ratio to their total lengths, are as follows :—

Ranikot.	Laki.	Khirthar.
44 per cent., *sindensis* . .	61 per cent, *alveolatus* .	58 per cent., *pinguis.*
47 per cent., sp. . . .	54 per cent., *pilgrimi* .	50 per cent., *rostratus.*
44 per cent., *declivis* . .	....	57 per cent., *galerus.*

There is thus, together with the family resemblance between the Indian types, an apparent general tendency (*a*) to increase the proportion of petal width, (*b*) to level up the petal lengths, and (*c*) to increase the relative height of the shell.[1] It is true that these results are based on the examination of only a very limited number of species. It is also true that discrepancies exist; thus *rostratus* is backward in (*a*) and (*c*) but advanced even for its stage in (*b*), while *alveolatus* is very advanced in respect of (*c*), but the general tendency does seem to exist, nevertheless.

It is interesting, therefore, to note that the proportions of *warthi* are in these respects as follows :—(*a*) 13·5 per cent., (*b*) 15 per cent., (*c*) 54 per cent. Thus although the horizon from which it came is not recorded, the proportions of *warthi* seem to indicate, in all three respects, that it belongs to the Laki stage. This, too, is probably the case; for as *warthi* was found near Jutana, the likelihood is that it came from the Eocene rocks in that vicinity,

[1] It will be noticed that the tendency is, in each case, to de-specialise the type. This may possibly be analogous to the partial de-specialisation of other types—*e.g.* the uncoiling of Ammonites—prior to their extinction. It will be remembered that *Conoclypeus* does not seem to have survived the Eocene.

and these seem to be limited to the Nummulitic limestone of the Punjab Salt Range, which I believe to be of Laki age. Thus I agree with Mr. Pinfold in thinking that this limestone is of infra-Khirthar character,[1] since I have found it capped, on the flanks of the Nilawan Ravine, by fossiliferous outliers of Laki clays. Dr. Pascoe is apparently also of the same opinion, as he classes this limestone as "Lower Nummulitic" and "Hill Limestone," *i.e.*, infra-Khirthar.[2] Throughout the Punjab Salt Range, too, including exposures at Jutana and in the Nilawan Ravine, this limestone seems to be underlain by gypseous beds with coaly layers, which seem to correspond to the "Meting Shales" (*cf. Mem., Geol. Surv. Ind.*, Vol. XIV, pp. 105, 138, 142, 192, etc.). Besides this, the limestone itself is characterised by the locally abundant presence of "large" gastropods, bivalves and echinoderms, together with *Orbitolites* and *Alveolinæ* (*ibid*, pp. 69, 106, etc.) All these are very definite indications that the Salt Range Nummulitic limestone corresponds to the mid-Laki "Alveolina Limestone." The great size of *warthi* also agrees well enough with its derivation from a horizon which has produced so many other large species, *e.g.*, *C. piligrimi* *Cerithium giganteum*, *Lucina gigantea*, etc.

It seems, therefore, that *C. pilgrimi* certainly, and *C. warthi* almost certainly, must be regarded as characterising the Alveolina Limestone level of the Indian Laki series. There are thus now three known species of this genus attributable to each of the three great Indian Eocene stages.

[1] *Rec., Geol. Surv. Ind.*, Vol. XLIX, p. 150.
[2] *Mem., Geol. Surv. Ind.*, Vol. XL, Pt. 3, pp. 343-344.

EXPLANATION OF PLATES.

PLATE 25, Fig. 1.—*Conoclypeus pilgrimi* (G. S I. Reg. No. 3422). Longitudinal profile of the test, seen from the right. Half size.

" " 2. (G. S. I. Reg. No. 3421).—The same, seen from the left. Half size.

" " 3. (G. S. I. Reg. No. 3420).—The same, seen from the rear. Half size.

" " 4. (G. S. I. Reg. No. 3417).—Abactinal view of the same specimen. Half size.

" " 5. (G. S. I. Reg. No. 3419).—Actinal view of another specimen. Half size.

EXPLANATION OF PLATES,—*contd.*

PLATE 25, Fig. 6. (G. S. I. Reg. No. 1252).—Actinal view of a young specimen. Half size.

„ 26 „ 1. (G. S. I. Reg. No. 3418).—Abactinal view of another specimen, to show shape of apical disc. Magnified $\frac{3}{2}$.

„ „ 2. (G. S. I. Reg. No. 1253).- Abactinal view of another specimen, to show imperforate rims round genital pores. Nat. size.

„ „ 3. (G. S. I. Reg. No. 3425).—*Conoclypeus warthi.* Longitudinal profile of the test, seen from the right. Half size.

„ „ 4. (G. S. I. Reg. No. 3426). —The same, seen from the rear. Half size.

„ „ 5. (G. S. I. Reg. No. 3424).—Abactinal view of the same. Half size.

„ „ 6. (G. S. I, Reg. No. 3423).—Actinal view of the same. Half size.

MISCELLANEOUS NOTE.

Ornament of heated Talc from Mohenjo Daro.

The specimen herein described was submitted for examination by the Archæological Survey, who obtained it from the excavations at Mohenjo-Daro in the Indus Valley. It is a broken fragment of what was originally a hollow circle, of the nature of a bangle, with a comparatively small internal diameter, probably of about 7 to 8 cms., and a depth of about 4 cms. The fragment received was a segment about 5 cms. in length; the maximum thickness was about 1·5 cms., tapering to the top and bottom by curvature of the outer surface. The inner surface was smooth; the outer surface had on it a pattern in relief consisting of pairs of circles and trefoils. The fragment had fractured at points where small circular holes pierced it from the outside to the inside, the holes being directed towards the centre of the circle.

There was evidence that the pattern had been carved and not moulded, as there were signs of the cutting tool having slipped in a few places.

The material had an irregular fracture, a specific gravity of 2·75 and a hardness of about 6. Under the microscope a thin section proved to be semi-transparent with fairly high relief, while a few grains irregularly disposed showed high polarization colours. There appeared to be an ill-defined cleavage and the outward appearance somewhat resembled felspar; the cleavage, however, was not sufficiently distinct, and the specific gravity and the refractive index were too high.

As no decision could be arrived at by physical and optical tests, a small fragment was broken off in such a way as not to damage the carving, and was analysed with the following result:

SiO_2	62·87 per cent.
Al_2O_3 & Fe_2O_3	3·13 per cent.
CaO	traces.
MgO	32·57 per cent.
	98·57

There was not sufficient material to allow determination of the moisture; some is present but the amount lies well within the 1·43 per cent. available in the above analysis.

The analysis corresponds very closely with the composition of talc, the only factor against it being the hardness. A piece of ordinary Indian steatite was, therefore, subjected to a temperature of 1150° C. for half an hour in the blow burner and was found to have acquired a hardness of approximately 6. It had lost the slightly grey, greasy look of the original material and was pure white with an irregular fracture resembling the specimen under investigation. A microscope slide was cut of this heated talc and its appearance

closely resembled that of the specimen under investigation. The only difference between the two slides was that it was impossible to cut the control section quite so thin before it began to break up.

It therefore appears evident that the Mohenjo-Daro specimen had been carved out of natural steatite in the first instance and had then been subjected to a high temperature which induced upon it the high hardness of 6. This most interesting case shows the high degree of technical knowledge and skill among this ancient civilization, the date of the city of Mohen-jo-Daro. from which the specimen was recovered having been placed at about the third millennium B. C.

G. V. HOBSON.

MGIPC—M—V-2-6—28-10-26—000

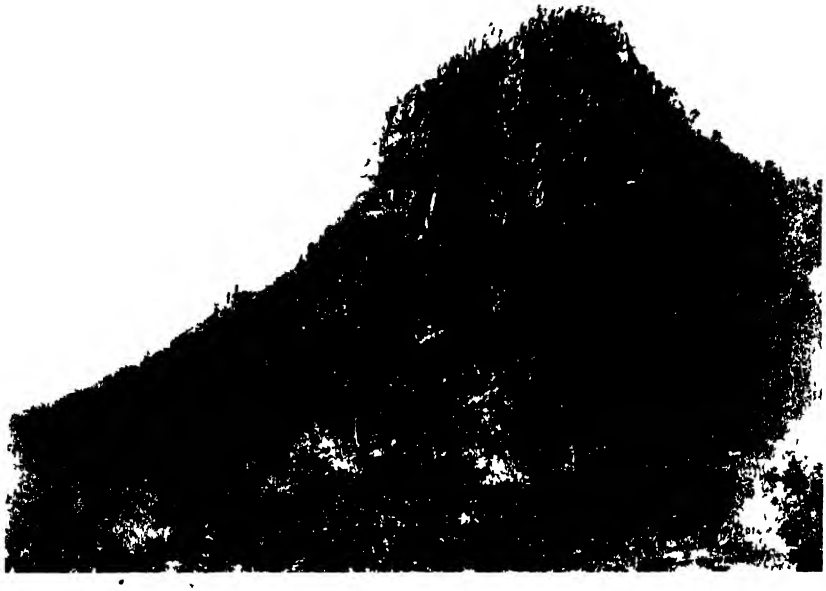
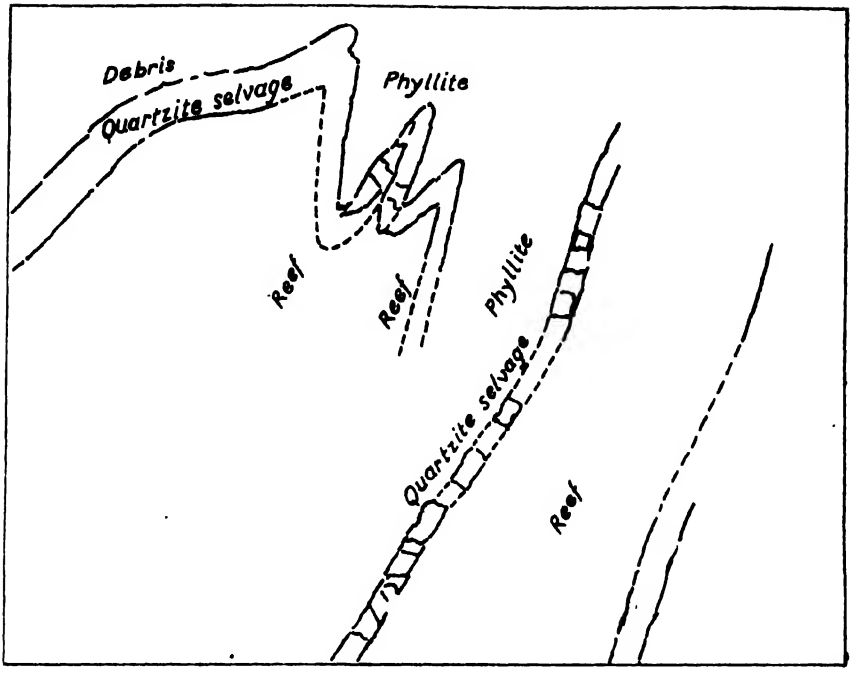


FIG 1 WEST END OF QUARTZITE RIDGE IN GORGE SOUTH OF UNDHANIA

G. I Hobson, Photo *G. S I Calcutta*

FIG 2. GENERAL VIEW OF PANI MINE FROM THE NORTH-WEST.


Debris
Quartzite selvage
Phyllite
Reef
Reef
Phyllite
Quartzite selvage
Reef

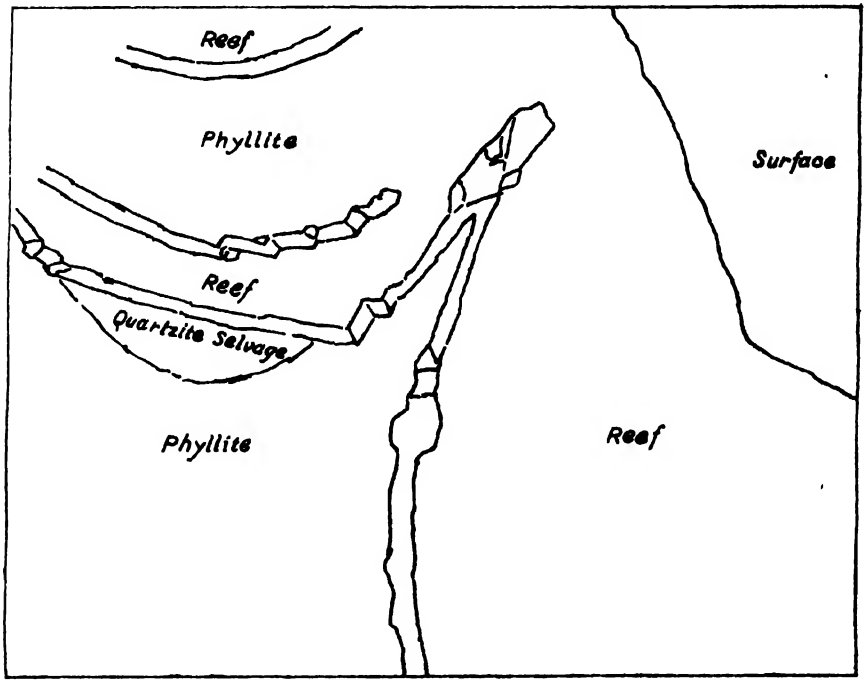
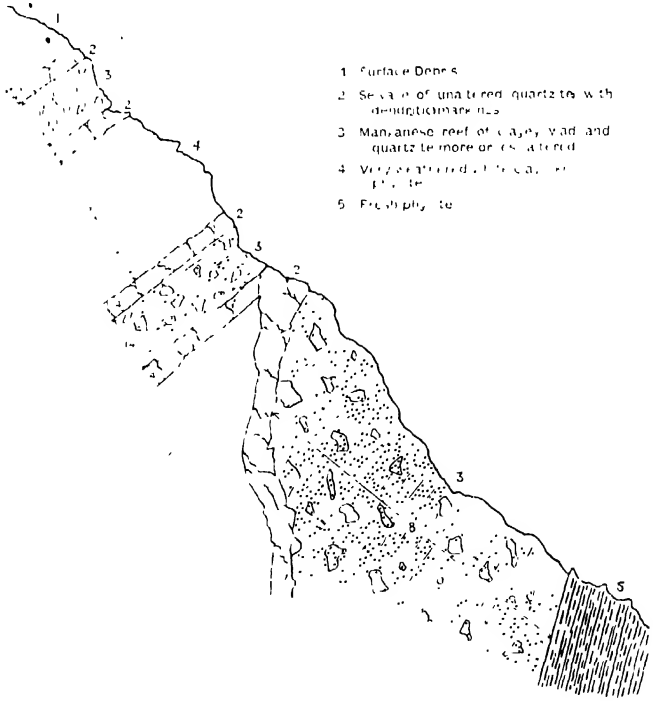

Reef
Phyllite
Surface
Reef
Quartzite Selvage
Phyllite
Reef

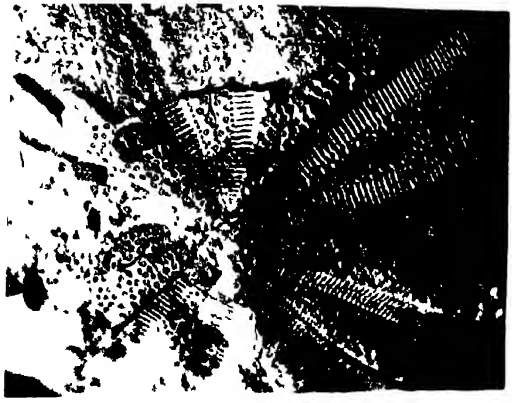
FIG 1. GRANITE-DOLERITE HYBRID ROCK, showing aggregates of secondary felspar needles in S. W quadrant and secondary felspar fringes round original crystals in centre and N E quadrant × 33

FIG. 2. GRANITE-DOLERITE HYBRID ROCK nicols crossed. Showing secondary felspa fringes in optical continuity with origina felspars. × 33.



G V Hobson & T. C. Chowdhury, Photos. *G S. I. Calcutt*

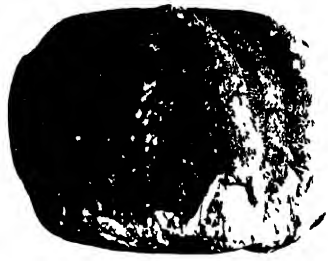
FIG. 3. SKETCH SECTION OF MANGANESE REEF AT EAST END OF PANI MINE.



1 3/2

2 *Nat. size.*

3



4

5

6

P L Dutt, Photos

G. S. I. Calcutta

CONOCLYPEUS

(All half natural size except figs 1 & 2)

Cobaltite and danaïte from Khetri mines, Rajputana; with remarks on Jaipurite (Syepoorite). Zinc-ore (Smithsonite and Blende) with barytes in Kamul district, Madras. Mud eruption in island of Cheduba.

Part 3 (out of print).—Artesian borings in India. Oligoclase granite at Wangtu on Sutlej, North-West Himalayas. Fish-plate from Siwaliks. Palæontological works from Hazaribagh and Lohardagga districts. Fossil carnivora from Siwalik hills.

Part 4.—Unification of geological nomenclature and cartography. Geology of Arvali region, central and eastern. Native antimony obtained at Pulo Obin, near Singapore. Turgite from Juggiapett, Kistnah District, and zinc carbonate from Karnul, Madras. Section from Dalhousie to Pangi, *viâ* Sach Pass. South Rewah Gondwana basin. Submerged forest on Bombay Island.

Vol. XV, 1882.

Part 1 (out of print).—Annual report for 1881. Geology of North West Kashmir and Khagan. Gondwana labyrinthodonts (Siwalik and Jamna mammals). Geology of Dalhousie, North-West Himalaya. Palm leaves from (tertiary) Murree and Kasauli beds in India. Iridosmine from Noa-Dihing river, Upper Assam, and Platinum from Chutia Nagpur. On (1) copper mine near Yongri hill, Darjiling district; (2) arsenical pyrites in same neighbourhood: (3) kaolin at Darjiling. Analyses of coal and fire-clay from Makum coal-fields, Upper Assam. Experiments on coal of Pind Dadun Khan, Salt-range, with reference to production of gas, made April 29th, 1881. International Congress of Bologna.

Part 2 (out of print).—Geology of Travançore State. Warkilli beds and reported associated deposits at Quilon, in Travancore. Siwalik and Narbada fossils. Coal-bearing rocks of Upper Rer and Mand rivers in Western Chutia Nagpur. Pench river coal field in Chhindwara district, Central Provinces. Boring for coal at Engsein, British Burma. Sapphires in North-Western Himalaya. Eruption of mud volcanoes in Cheduba.

Part 3.—Coal of Mach (Much) in Bolan Pass, and of Sharigh on Harnai route between Sibi and Quetta. Crystals of stilbite from Western Ghats, Bombay. Traps of Darang and Mandi in North-Western Himalayas. Connexion between Hazara and Kashmir series. Umaria coal field (South Rewah Gondwana basin). Daranggiri coal fields, Garo Hills, Assam. Coal in Myanoung division, Henzada district.

Part 4 (out of print).—Gold-fields of Mysore. Borings for coal at Beddadanol, Godavari district, in 1874. Supposed occurrence of coal on Kistna.

Vol. XVI, 1885.

Part 1.—Annual report for 1882. Richthofenia Kays (Anomia Lawrenciana, Koninck). Geology of South Travancore. Geology of Chamba. Basalts of Bombay.

Part 2 (out of print).—Synopsis of fossil vertebrata of India. Bijoli Labyrinthodont. Skull of Hippotherium antilopinum. Iron ores, and subsidiary materials for manufacture of iron, in north-eastern part of Jabalpur district. Laterite and other manganese ore occurring at Gosulpore, Jabalpur district. Umaria coal-field.

Part 3. Microscopic structure of some Dalhousie rocks. Lavas of Aden. Probable occurrence of Siwalik strata in China and Japan. Mastodon angustiden in India. Traverse between Almora and Mussooree. Cretaceous coal-measures at Borsora, in Khasia Hills, near Lacur, in Sylhet.

Part 4 (out of print).—Palæontological notes from Daltonganj and Hutar coal-fields in Chota Nagpur. Altered basalts of Dalhousie region in North-Western Himalayas. Microscopic structure of some Sub-Himalayan rocks of tertiary age. Geology of Jaunsar and Lower Himalayas. Traverse through Eastern Khasia, Jaintia, and North Cachar Hills. Native lead from Maulmain and chromite from the Andaman Islands. Fiery eruption from one of the mud volcanoes of Cheduba Island, Arakan. Irrigation from wells in North Western Provinces and Oudh.

Vol. XVII, 1884.

Part 1.—Annual report for 1883. Smooth water anchorages at mud banks of Narrakal and Alleppy on Travancore coast. Billa Surgam and other caves in Kurnool district. Geology of Chaurai and Sihunta parganas of Chamba. Lyttonia, Waagen, in Kulm series of Kashmir.

Part 2 (out of print).—Earthquake of 31st December 1881. Microscopic structure of some Himalayan granites and gneissose granites. Chor coal exploration. Re-discovery of fossils in Siwalik beds. Mineral resources of Andaman Islands in neighbourhood of Port Blair. Intertrappean beds in Deccan and Laramie group in Western North America.

Part 3 (out of print).—Microscopic structure of some Arvali rocks. Section along Indus from Peshawar Valley to Salt range. Sites for boring in Raigarh-Hingir coal field (first notice). Lignite near Raipore, Central Provinces. Turquoise mines of Nishapur, Khorassan. Fiery eruption from Minbyin mud volcano of Cheduba island, Arakan. Langrin coal-field, South Western Khasia Hills. Umaria coal-field.

Part 4 —Geology of part of Gangasulan pargana of British Garhwal. Jhalia and schists imbedded in gneissose granite of North West Himalayas. Geology of Takhti-i Sulaiman Smooth water anchorages of Travancore coast. Auriferous sands of the Subansiri river, Pondicherry lignite, and phosphatic rocks at Musuri. Billa Surgam caves

VOL XVIII, 1885

Part 1 (out of print) Annual report for 1884 Country between Singareni coal-field and Kistna river Geological sketch of country between Singareni coal-field and Hyderabad. Coal and limestone in Dolgrung river near Golaghat Assam. Homotaxis, as illustrated from Indian formations. Afghan field notes.

Part 2 —Fossiliferous series in Lower Himalaya, Garhwal. Age of Mandhali series in Lower Himalaya. Siwalik camel (Camelus Antiquus, nobis ex Falc. and Caut. MS.). Geology Chamba Probability of obtaining water by means of artesian wells in plains of Upper India Artesian sources in plains of Upper India. Geology of Aka Hills. Alleged tendency of Arakan mud volcanoes to burst into eruption most frequently during rains Analyses of phosphatic nodules and rock from Mussooree.

Part 3 (out of print) – Geology of Andaman Islands Third species of Merycopotamus Percolation as affected by current Pithalla and Chandpur meteorites Oil-wells and coal in Thayetmyo District, British Burma Antimony deposits in Maulmain district. Kashmir earthquake of 30th May 1885 Bengal earthquake of 14th July 1885.

Part 4 (out of print) Geological work in Chhattisgarh division of Central Provinces Bengal earthquake of 14th July 1885 Kashmir earthquake of 30th May 1885 Excavations in Billa Surgam caves Nepaulite. Sabetmahet meteorite

VOL XIX, 1886.

Part 1 – Annual report for 1885 International Geological Congress of Berlin. Palæozoic fossils in Olive group of Salt-range Correlation of Indian and Australian coal-bearing beds Afghan and Persian field notes Section from Simla to Wangtu, and petrological character of Amphibolites and Quartz Diorites of Sutlej valley.

Part 2 (out of print) Geology of parts of Bellary and Anantapur districts. Geology of Upper Dihing basin in Singpho Hills Microscopic characters of eruptive rocks from Central Himalayas. Mammalia of Karnul Caves Prospects of finding coal in Western Rajputana Olive group of Salt range Boulder beds of Salt-range Gondwana Homotaxis

Part 3 (out of print) –Geological sketch of Vizagapatam district, Madras Geology of Northern Jesalmer Microscopic structure of Malani rocks of Aravali region Malanj khandi copper ore in Balaghat district, C P

Part 4 (out of print) Petroleum in India Petroleum exploration at Khatan Boring in Chhattisgarh coal fields Field notes from Afghanistan. No 3, Turkistan Fiery eruption from one of the mud volcanoes of Cheduba Island, Arakan Nammianthal aerolite Analysis of gold dust from Meza valley, Upper Burma

VOL XX, 1887

Part 1 Annual report for 1886 Field notes from Afghanistan No 4, from Turkistan to India Physical geology of West British Garhwal, with notes on a route traversed through Jaunsar Bawar and Tirl Garhwal. Geology of Garo Hills. Indian image-stones Soundings recently taken off Barren Island and Narcondam. Talchir boulder beds Analysis of Phosphatic Nodules from Salt-range, Punjab.

Part 2 – Fossil vertebrata of India Echinoidea of cretaceous series of Lower Narbada Valley Field notes No 5 to accompany geological sketch map of Afghanistan and North Eastern Khorassan Microscopic structure of Rajmahal and Deccan traps Dolerite of Chor Identity of Olive series in east with speckled sandstone in west of Salt range in Punjab

Part 3 Retirement of Mr Medlicott J B Muskietoff's Geology of Russian Turkistan Crystalline and metamorphic rocks of Lower Himalaya, Garhwal, and Kumaun, Section I Geology of Simla and Jutogh 'Lalitpur' meteorite

Part 4 (out of print) – Points in Himalayan geology. Crystalline and metamorphic rocks of Lower Himalaya, Garhwal, and Kumaon, Section II. Iron industry of western portion of Raipur Notes on Upper Burma. Boring exploration in Chhattisgarh coal-fields (Second notice) Pressure Metamorphism, with reference to foliation of Himalayan Gneissose Granite Papers on Himalayan Geology and Microscopic Petrology

VOL XXI, 1888

Part 1 – Annual report for 1887 Crystalline and metamorphic rocks of Lower Himalaya, Garhwal and Kumaun Section III Birds'-nest of Elephant Island, Mergui Archipelago Exploration of Jesalmer, with a view to discovery of coal. Facetted pebble from boulder bed ('speckled sandstone') of Mount Chel in Salt range, Punjab Nodular stones obtained off Colombo.

Part 2 (out of print).—Award of Wollaston Gold Medal, Geological Society of London, 1886. Dharwar System in South India. Igneous rocks of Raipur and Balaghat, Central Provinces. Sangar Marg and Mehowgale coal-fields, Kashmir.

Part 3 (out of print).—Manganese Iron and Manganese Ores of Jabalpur. 'The Carboniferous Glacial Period.' Pre tertiary sedimentary formation of Simla region of Lower Himalayas.

Part 4 (out of print).—Indian fossil vertebrates. Geology of North-West Himalayas. Blown-sand rock sculpture. Nummulites in Zanskar Mica traps from Barakar and Raniganj.

VOL. XXII, 1889.

Part 1 (out of print).—Annual report for 1888. Dharwar System in South India. Wajra Karur diamonds, and M. Chaper's alleged discovery of diamonds in pegmatite. Generic position of so-called Plesiosaurus Indicus. Flexible sandstone or Itacolumite, its nature, mode of occurrence in India, and cause of its flexibility. Siwalik and Narbada Chelonia.

Part 2 (out of print).—Indian Steatite. Distorted pebbles in Siwalik conglomerate "Carboniferous Glacial Period." Notes on Dr. W. Waagen's "Carboniferous Glacial Period." Oil-fields of Twingoung and Beme, Burma. Gypsum of Nehal Nadi, Kumaun. Materials for pottery in neighbourhood of Jabalpur and Umaria.

Part 3 (out of print).—Coal outcrops in Sharigh Valley, Baluchistan. Trilobites in Neobolus beds of Salt-range. Geological notes Cherra Poonjee coal-field, in Khasia Hills. Cobaltiferous Matt from Nepal. President of Geological Society of London on International Geological Congress of 1888. Tin-mining in Mergui district.

Part 4 (out of print).—Land-tortoises of Siwaliks. Pelvis of a ruminant from Siwaliks. Assays from Sambhar Salt-Lake in Rajputana. Manganiferous iron and Manganese Ores of Jabalpur. Palagonite-bearing traps of Rájmahál hills and Deccan. Tin-smelting in Malay Peninsula. Provisional Index of Local Distribution of Important Minerals, Miscellaneous Minerals, Gem Stones and Quarry Stones in Indian Empire: Part 1.

VOL. XXIII, 1890.

Part 1 (out of print).—Annual report for 1889. Lakadong coal-fields, Jaintia Hills. Pectoral and pelvic girdles and skull of Indian Dicynodonts. Vertebrate remains from Nagpur district (with description of fish skull). Crystalline and metamorphic rocks of Lower Himalayas, Garhwál and Kumaon, Section IV. Bivalves of Olive-group, Salt-range. Mud-banks of Travancore coasts.

Part 2 (out of print).—Petroleum explorations in Harnai district, Baluchistan. Sapphire Mine of Kashmir. Supposed Matrix of Diamond at Wajra Karur, Madras. Sonapét Gold-field. Field notes from Shan Hills (Upper Burma). New species of Syringe osphæridæ.

Part 3 (out of print).—Geology and Economic Resources of Country adjoining Sind-Pishin Railway between Sharigh and Spintangi, and of country between it and Khattan Journey through India in 1888-89, by Dr. Johannes Walther. Coal-fields of Lair ungao, Maosandram, and Mao-be-lar-kar, in the Khasi Hills. Indian Steatite. Provisional Index of Local Distribution of Important Minerals. Miscellaneous Minerals, Gem Stones, and Quarry Stones in Indian Empire.

Part 4 (out of print).—Geological sketch of Naini Tal; with remarks on natural conditions governing mountain slopes. Fossil Indian and Bones. Darjiling Coal between Lisu and Ramthi rivers. Basic Eruptive Rocks of Kadapah Area. Deep Boring at Lucknow. Coal Seam of Dore Ravine, Hazara.

VOL. XXIV, 1891.

Part 1 (out of print).—Geological sketch of Naini Tal: with remarks on natural conditions re-considered theory of Origin and Age of Salt-Marl. Graphite in decomposed Gneiss (Laterite) in Ceylon. Glaciers of Kabru, Pandim, etc. Salts of Sambhar Lake in Rajputana, and 'Reh' from Aligarh in North-Western Provinces. Analysis of Dolomite from Salt-range, Punjab.

Part 2 (out of print).—Oil near Moghal Kot, in Sherani country, Suleiman Hills. Mineral States. Reported Namséka Ruby-Mine in Mainglôn State. Tourmaline (School) Mines in Mainglôn State. Salt-spring near Bawgyo, Thibaw State.

Part 3 (out of print).—Boring in Daltongunj Coal-field, Palamow. Death of Dr. P. Martin Duncan. Pyroxenic varieties of Gneiss and Scapolite-bearing Rocks.

Part 4 (out of print).—Mammalian Bones from Mongolia. Darjiling Coal Exploration. Geology and Mineral Resources of Sikkim. Rocks from the Salt-range, Punjab.

VOL. XXV, 1892.

Part 1 (out of print).—Annual report for 1891. Geology of Thal Chotiáli and part of Mari country. Petrological Notes on Boulder-bed of Salt-range, Punjab. Sub-recent and Recent Deposits of valley plains of Quetta, Pishin, and Dasht-i-Bedalot; with appendices on Chamans of Quetta; and Artesian water supply of Quetta and Pishin.

Part 2 (out of print).—Geology of Saféd Kôh. Jherria Coal-field.

Part 3 (out of print) -Locality of Indian Tscheffkinite. Geological Sketch of country north of Bhamo. Economic resources of Amber and Jade mines area in Upper Burma. Iron ores and Iron industries of Salem District. Riebeckite in India. Coal on Great Tenasserim River, Lower Burma.

Part 4 (out of print)- Oil Springs at Mogal Kot in Shirani Hills. Mineral Oil from Suleiman Hills. New Amber-like Resin in Burma. Triassic Deposits of Salt-range.

VOL XXVI, 1893.

Part 1 (out of print)—Annual report for 1892. Central Himalayas. Jadeite in Upper Burma Burmite, new Fossil Resin from Upper Burma. Prospecting Operations, Mergui District, 1891-92.

Part 2 (out of print)—Earthquake in Baluchistan of 20th December 1892. Burmite, new amber-like fossils from Upper Burma. Alluvial deposits and Subterranean water-supply of Rangoon.

Part 3 (out of print)—Geology of Sherani Hills Carboniferous Fossils from Tenasserim. Boring at Chandernagore Granite in Tavoy and Mergui.

Part 4 (out of print)—Geology of country between Chappar Rift and Harnai in Baluchistan. Geology of part of Tenasserim Valley with special reference to Tendau-Kamapying Coal field. Magnetite containing Manganese and Alumina. Hislopite.

VOL. XXVII, 1894.

Part 1 (out of print).- Annual report for 1893. Bhaganwala Coal-field, Salt-range, Punjab.

Part 2 (out of print).—Petroleum from Burma. Singareni Coal-field, Hyderabad (Deccan). Gohna Landslip, Garhwal.

Part 3 (out of print).--Cambrian Formation of Eastern Salt-range. Giridih (Karharbari) Coal fields. Chipped (?) Flints in Upper Miocene of Burma. Velates Schmideliana. Chemn., and Provelates grandis, Sow. sp., in Tertiary Formation of India and Burma.

Part 4 (out of print).—Geology of Wuntho in Upper Burma. Echinoids from Upper Cretaceous System of Baluchistán Highly Phosphatic Mica Peridotites intrusive in Lower Gondwana Rocks of Bengal. Mica-Hypersthene-Hornblende Peridotite in Bengal

VOL XXVIII, 1895

Part 1.—Annual report for 1894 Cretaceous Formation of Pondicherry. Early allusion to Barren Island. Bibliography of Barren Island and Narcondam from 1884 to 1894.

Part 2 (out of print) Cretaceous Rocks of Southern India and geographical conditions during later cretaceous times Experimental Boring for Petroleum at Sukkur from October 1893 to March 1895 Tertiary system in Burma

Part 3 —Jadeit and other rocks, from Tammaw in Upper Burma. Geology of Tochi Valley Lower Gondwanas in Argentina.

Part 4 (out of print) Igneous Rocks of Giridih (Kurhurbaree) Coal-field and their Contract Effects Vindhyan system south of Sone and their relation to so-called Lower Vindhyans Lower Vindhyan area of Sone Valley. Tertiary system in Burma.

VOL. XXIX, 1896.

Part 1.—Annual report for 1895. Acicular inclusions in Indian Garnets. Origin and Growth of Garnets and of their Micropegmatitic intergrowths in Pyroxenic rocks.

Part 2 (out of print) Ultrabasic rock and derived minerals of Chalk (Magnesite) hills, and other localities near Salem, Madras Corundum localities in Salem and Coimbatore districts, Madras Corundum and Kyanite in Manbhum district, Bengal. Ancient Geography of "Goudwana land." Notes.

Part 3. Igneous Rocks from the Tochi Valley. Notes.

Part 4 (out of print) Steatite mines, Manbu district, Burma. Lower Vindhyan (Sub-Kaimur) area of Sone Valley, Rewah. Notes.

VOL. XXX, 1897.

Part 1 Annual report for 1896 Norite and associated Basic Dykes and Lava-flows in Southern India Genus Vertebraria. On Glossopteris and Vertebraria.

Part 2 Cretaceous Deposits of Pondicherry Note

Part 3 (out of print)—Flow structure in igneous dyke. Olivine-norite dykes at Coonoor. Excavations for corundum near Palakod, Salem District. Occurrence of coal at Palana in Bikanir. Geological specimens collected by Afghan-Baluch Boundary Commission of 1896

Part 4 (out of print)—Nemalite from Afghanistan Quartz-barytes rock in Salem district, Madras Presidency. Worn femur of Hippopotamus irravadicus, Caut. and Falc., from Lower Pliocene of Burma. Supposed coal at Jaintia, Baxa Duars. Percussion Figures on micas. Notes

VOL. XXXI, 1904

Part 1 (out of print)—Prefatory Notice. Copper ore near Komai, Darjeeling district Zewan beds in Vihi district Kashmir Coal deposits of Isa Khel, Mianwali district, Punjab Um-Ruleng coal-beds, Assam Sapphirine bearing rock from Vizagapatam District Miscellaneous Notes. Assays.

Part 2 (out of print).—Lt.-Gen. C. A. McMahon. Cyclobus Haydeni Diener. Auriferous Occurrences of Chota Nagpur, Bengal. On the feasibility of introducing modern methods of Coke-making at East Indian Railway Collieries, with supplementary notes by Director, Geological Survey of India. Miscellaneous Notes.

Part 3 (out of print).—Upper Palæozoic formations of Eurasia. Glaciation and History of Sind Valley. Halorites in Trias of Baluchistan. Geology and Mineral Resources of Mayurbhanj. Miscellaneous Notes.

Part 4 (out of print).—Geology of Upper Assam. Auriferous Occurrences of Assam. Curious occurrence of Scapolite from Madras Presidency. Miscellaneous Notes. Index.

Vol. XXXII, 1905.

Part 1.—Review of Mineral production of India during 1898–1903.

Part 2 (out of print).—General report, April 1903 to December 1904. Geology of Provinces of Tsang and Ü in Tibet. Bauxite in India. Miscellaneous Notes.

Part 3.—*(out of print).*—Anthracolithic Fauna from Subansiri Gorge, Assam. Elephas Antiquus (Namadicus) in Godavari Alluvium. Triassic Fauna of Tropites-Limestone of Byans. Amblygonite in Kashmir. Miscellaneous Notes.

Part 4.—Obituary notices of H. B. Medlicott and W. T. Blanford. Kangra Earthquake of 4th April 1905. Index to Volume XXXII.

Vol. XXXIII, 1906.

Part 1 (out of print).—Mineral Production of India during 1904. Pleistocene Movement in Indian Peninsula. Recent Changes in Course of Nam tu River, Northern Shan States. Natural Bridge in Gokteik Gorge. Geology and Mineral Resources of Narnaul District (Patiala State). Miscellaneous Notes

Part 2.—General report for 1905. Lashio Coal-field, Northern Shan States. Namma, Mansang and Man-so-le Coal-fields, Northern Shan States, Burma. Miscellaneous Notes

Part 3 (out of print).—Petrology and Manganese-ore Deposits of Sausar Tahsil, Chhindwara district, Central Provinces. Geology of part of valley of Kannan River in Nagpur and Chhindwara districts, Central Provinces. Manganite from Sandur Hills. Miscellaneous Notes

Part 4.—*(out of print).*—Composition and Quality of Indian Coals. Classification of the Vindhyan System. Geology of State of Panna with reference to the Diamond-bearing Deposits. Index to Volume XXXIII.

Vol. XXXIV, 1907.

Part 1 (out of print).—Fossils from Halorites Limestone of Bambanag Cliff, Kumaon. Upper Triassic Fauna from Pishin District, Baluchistan. Geology of portion of Bhutan. Coal Occurrences in Foot hills of Bhutan. Dandli Coal-field; Coal outcrops in Kotli Tehsil of Jammu State. Miscellaneous Notes.

Part 2 (out of print).—Mineral production of India during 1905. Nummulites Douvillei, with remarks on Zonal Distribution of Indian Nummulites. Auriferous Tracts in Southern India. Abandonment of Collieries at Warora, Central Provinces. Miscellaneous Notes.

Part 3 (out of print).—Explosion Craters in Lower Chindwin District, Burma. Lavas of Pavagad Hill. Gibbsite with Manganese-ore from Talevadi, Belgaum district, and Gibbsite from Bhakowli, Satara District. Classification of Tertiary System in Sind with reference to Zonal distribution of Eocene Echinoidea.

Part 4 (out of print).—Jaipur and Nazira Coal-fields, Upper Assam. Makum Coal-field between Tirap and Namdang Streams. Kohat Anticline, near Seiktein, Myingyan district, Upper Burma. Asymmetry of Yenangyat-Singu Anticline, Upper Burma. Northern part of Gwegyo Anticline, Myingyan District, Upper Burma. Breynia Multituberculata, from Nari of Baluchistan and Sind. Index to Volume XXXIV

Vol. XXXV, 1907.

Part 1 (out of print).—General report for 1906. Orthophragmina and Lepidocyclina in Nummulitic Series. Meteoric Shower of 22nd October 1903 at Dokachi and neighbourhood, Dacca district.

Part 2.—Indian Aerolites. Brine-wells at Bawgyo, Northern Shan States. Gold-bearing Deposits of Loi Twang, Shan States. Physa Prinsepii in Maestrichtian strata of Baluchistan. Miscellaneous Notes.

Part 3.—Preliminary survey of certain Glaciers in North-West Himalaya. B.—Notes on certain Glaciers in North-West Kashmir.

Part 4.—Preliminary survey of certain Glaciers in North-West Himalaya. B.—Notes on certain Glaciers in Lahaul. C.—Notes on certain Glaciers in Kumaon. Index to Volume XXXV.

VOL. XXXVI, 1907-08.

Part 1 (out of print).—Petrological Study of Rocks from hill tracts, Vizagapatam district, Madras Presidency Nepheline Syenites from hill tracts, Vizagapatam district, Madras Presidency. Stratigraphical Position of Gangamopteris Beds of Kashmir. Volcanic outburst of Late Tertiary Age in South Hsenwi, N. Shan States. New suids from Bugti Hills, Baluchistan Permo-Carboniferous Plants from Kashmir.

Part 2.- Mineral Production of India during 1906. Ammonites of Bagh Beds. Miscellaneous Notes.

Part 3.- Marine fossils in Yenangyaung oil-field, Upper Burma. Freshwater shells of genus Batissa in Yenangyaung oil-field, Upper Burma. New Species of Dendrophyllia from Upper Miocene of Burma. Structure and age of Taungtha hills, Myingyan district, Upper Burma. Fossils from Sedimentary rocks of Oman (Arabia) Rubies in Kachin hills, Upper Burma. Cretaceous Orbitoides of India. Two Calcutta Earthquakes of 1906. Miscellaneous Notes.

Part 4.—Pseudo Fucoids from Pab sandstones at Fort Munro, and from Vindhyan series Jadeite in Kachin Hills, Upper Burma. Wetchok-Yedwet Pegu outcrop, Magwe district, Upper Burma. Group of Manganates, comprising Hollandite, Psilomilane and Coronadite. Occurrence of Wolfram in Nagpur district, Central Provinces. Miscellaneous Notes. Index to Volume XXXVI.

VOL. XXXVII, 1908-09.

Part 1 (out of print).—General report for 1907. Mineral Production of India during 1907. Occurrence of striated boulders in Blaini formation of Simla. Miscellaneous Notes.

Part 2 (out of print).—Tertiary and Post-Tertiary Freshwater Deposits of Baluchistan and Sind. Geology and Mineral Resources of Rajpipla State. Suitability of sands in Rajmahal Hills for glass manufacture. Three new Manganese-bearing minerals :— Vredenburgite, Sitaparite and Juddite Laterites from Central Provinces. Miscellaneous Notes.

Part 3.—Southern part of Gwegyo Hills, including Payagyigon-Ngashandaung Oil-field. Silver-lead mines of Bawdwin, Northern Shan States. Mud volcanoes of Arakan Coast, Burma.

Part 4.—Gypsum Deposits in Hamirpur district, United Provinces. Gondwanas and related marine sedimntary system of Kashmir. Miscellaneous Notes. Index to Volume XXXVII.

VOL XXXVIII, 1909-10.

Part 1.—General report for 1908. Mineral Production of India during 1908.

Part 2 (out of print).—Ostrea latimarginata in "Yenangyaung stage" of Burma. China clay and Fire-clay deposits in Rajmahal Hills. Coal at Gilhurria in Rajmahal hills Pegu Inlier at Oudwe, Magwe district, Upper Burma. Salt Deposits of Rajputana. Miscellaneous Notes.

Part 3.—Geology of Sarawan, Jhalawan, Mekran and the State of Las Bela. Hippurite-bearing Limestone in Seistan and Geology of adjoining region. Fusulinidæ from Afghanistan Miscellaneous Notes.

Part 4.- Geology and Prospects of Oil in Western Prome and Kama, Lower Burma (including Namayan, Padaung, Taunghogyi and Ziaing). Correlation of Pegu system in Burma with notes on Horizon of Oil bearing Strata (including Geology of Padaukpin, Banbyin and Aukmanein). Fossil Fish Teeth from Pegu system. Burma Northern part of Yenangyat Oilfield Iron Ores of Chanda, Central Provinces Geology of Aden Hinterland Petrological Notes on rocks near Aden Upper Jurassic Fossils near Aden. Miscellaneous Notes. Index to Volume XXXVIII.

VOL. XXXIX, 1910.

Quinquennial Review of Mineral Production of India during 1904 to 1908.

VOL. XL, 1910.

Part 1.—Pre-Carboniferous Life-Provinces Lakes of Salt Range in the Punjab. Preliminary survey of certain Glaciers in Himalaya. D.—Notes on certain glaciers in Sikkim New Mammalian Genera and Species from Tertiaries of India.

Part 2.—General Report for 1909. Mineral Production of India during 1909.

Part 2.—General Report for 1909. Mineral Production of India during 1909. Silurian Trias Sequence in Kashmir Fenestella-bearing beds in Kashmir.

Part 4.—Alum Shale and Alum Manufacture Kalabagh, Mianwali district, Punjab. Coal fields in North-Eastern Assam. Sedimentary Deposition of Oil. Miscellaneous Notes Index to Volume XL.

VOL. XLI, 1911-12.

Part 1. Age and continuation in Depth of Manganese-ores of Nagpur-Balaghat Area, Central Provinces. Manganese-ore deposits of Rangpur State, Bengal, and Distri- Identity of Ostrea Promensis, Noetling, from Pegu System of Burma and Ostrea Digitalsma Eichwald, from Miocene of Europe. Mr. T. R. Blyth Miscellaneous Digitalsma Eichwald from Miocene of Europe. Mr. T. R. Blyth. Miscellaneous Notes

Part 2.—General report for 1910. Eocenian Fossils from Chitral, Persia, Afghanistan and Hindustan. Gastropoda in Pir Panjal Range and Shaj Valley, Kashmir.

Part 3.—Mineral Production of India during 1910. Samarskite and other minerals in Nellore District, Madras Presidency. Coal in Namchik Valley, Upper Assam. Miscellaneous Notes.

Part 4.—Pegu-Eocene Succession in Minbu District near Ngapa. Geology of Hanzada District, Burma. Geology of Lonar Lake, with note on Lonar Soda Deposit. International Geological Congress of Stockholm. Miscellaneous Notes. Index to Volume XLI.

Vol. XLII, 1912

Part 1.—Survival of Miocene Oyster in Recent Seas. Silurian Fossils from Kashmir. Blödite from Salt Range. Gold-bearing Deposits of Mong Long, Hsipaw State, Northern Shan States, Burma. Steatite Deposits, Idar State. Miscellaneous Notes.

Part 2.—General Report for 1911. Dicotyledonous Leaves from Coal Measures of Assam. Poting Glacier, Kumaon, Himalaya, June 1911. Miscellaneous Notes.

Part 3.—Mineral Production of India during 1911. Kodurite Series.

Part 4.—Geological Reconnaissances through Dehong Valley, being Geological Results of Abor Expedition, 1911-12. Traverse Across the Naga Hills of Assam. Indian Aërolites. Miscellaneous Notes.

Vol. XLIII, 1913

Part 1 (out of print).—General Report for 1912. Garnet as a Geological Barometer. Wolframite in Tavoy District, Lower Burma. Miscellaneous Notes.

Part 2.—Mineral Production of India during 1912. Relationship of the Himalaya to the Indo-Gangetic Plain and the Indian Peninsula. Pamirgite from Kashmir.

Part 3.—Contributions to the geology of the Province of Yünnan in Western China: I. Bhamo-Têng-Yueh Area: II. Petrology of Volcanic Rocks of Têng-Yueh District. The Khasia Hills. Bansawal Aerolite.

Part 4.—Gold-bearing Alluvium of Chindwin River and Tributaries. Correlation of Siwaliks with Mammal Horizons of Europe. Contributions to the Geology of the Province of Yünnan in Western China: III. Stratigraphy of Ordovician and Silurian Beds of Western Yünnan, with Provisional Palæontological Determinations. Notes on "Camaroerinus Asiaticus" from Burma.

Vol. XLIV, 1914.

Part 1.—General Report for 1913. Carbonaceous Aërolite from Rajputana. Nummulites as Zone Fossils, with description of some Burmese species.

Part 2.—Contributions to the Geology of the Province of Yunnan in Western China: IV. Country around Yunnan Fu. Dyke of White Trap from Pench Valley Coal-field, Chhindwara District, Central Provinces. Mineral concessions during 1913.

Part 3.—Coal-seams near Yaw River, Pakokku District, Upper Burma. The Monazite Sands of Travancore. Lower Cretaceous Fauna from Gneumal Sandstone and Chikkim series. Indarctos salmontanus Pilgrim. Burma Beheading of Son and Re-Rivers by Hasdo.

Part 4.—Salt Deposits of Cis-Indus Salt Range. Teeth referable to Lower Siwalik Creodont genus Dissopsalis Pilgrim. Glaciers of Dhauli and Lissar Valleys, Kumaon Himalaya, September 1912. Miscellaneous Notes.

Vol. XLV, 1915.

Part 1.—New Siwalik Primates. Brachiopoda of Namyau Beds of Burma. Miscellaneous Note.

Part 2.—General Report for 1914. Note on Sivaelurus and Paramachaerodus.

Part 3.—Mineral Production of India during 1914. Three New Indian Meteorites: Kuttippuram, Shupiyan and Kamsagar. Dentition of Tragulid Genus Dorcabune. Hematite Crystals of Corundiform Habit from Kajhidongri, Central India.

Part 4.—Geology of country near Ngahlaingdwin. Geology of Chitral, Gilgit and Pamirs.

Vol. XLVI, 1915.

Quinquennial Review of Mineral Production of India for 1909 to 1913.

Vol. XLVII, 1916.

Part 1.—General Report for 1915. Eocene Mammals from Burma. Miscellaneous Notes.

Part 2.—The Deccan Trap Flows of Linga, Chhindwara District, Central Provinces. Iron Ore Deposits of Tumbagé, Northern Shan States.

Part 3.—Obituary: R. C. Burton. The Mineral Production of India during 1915. Flemingostrea, an eastern group of Upper Cretaceous and Eocene Ostreidæ, with descriptions of two new species.

Part 4.—Contributions to the Geology of the Province of Yunnan in Western China: V. Geology of parts of the Salween and Mekong Valleys. A fossil wood from Burma. The Yinpun and Kah Khara Aerolites.

species. Structure of Cuticle in Glossopteris angustifolia Brongn. Revision of some Fossil Balanomorph Barnacles from India and the East Indian Archipelago. Contributions to the Geology of the Province of Yunnan in Western China. 7: Reconnaissance Surveys between Shunning Fu, Chingtung Ting and Tali Fu. 8: Traverse down Yang-tze-chiang Valley from Chin-chiang-kai to Hui li Chou. Boulder Beds beneath Utatur Stage, Trichinopoly District. Miscellaneous Notes.

Part 4.—Geology of Western Jaipur. Geological Traverses from Assam to Myitkyina through Hukong Valley; Myitkyina to Northern Putao; and Myitkyina to Chinese Frontier. Oligocene Echinoidea collected by Rao Bahadur S. Setha Rama Rau in Burma. Mineral Resources of Kolhapur State. Kunghka and Manmaksang Iron Ore Deposits, Northern Shan States, Burma.

VOL. LV, 1923-24.

Part 1.—General Report for 1922. Indian Tertiary Gastropoda, No. 5, Fusidæ, Turbinellidæ, Chrysodomidæ, Strepturidæ, Buccinidæ, Nassidæ, Columbellidæ with short diagnoses of new species. Geological Interpretation of some Recent Geodetic Investigations (being a second Appendix to the Memoir on the structure of the Himalayas and of the Gangetic Plain as elucidated by Geodetic Observations in India).

Part 2.—Obituary: Ernest (Watson) Vredenburg. Fossil Molluscs from Oil-Measures of Dawna Hills, Tenasserim. Armoured Dinosaur from Lameta Beds of Jubbulpore. Fossil forms of Placuna. Phylogeny of some Turbinellidae. Recent Falls of Aerolites in India. Geology of part of Khasi and Jaintia Hills, Assam.

Part 3.—Mineral Production of India during 1922. Lignitic Coal-fields in Karewa Formation of Kashmir Valley. Basic and Ultra-Basic Members of the Charnockite Series in the Central Provinces. China Clay of Kuralgi, Khanapur, Belgaum District.

Part 4.—Obituary: Henry Hubert Hayden. Oil Shales of Eastern Amherst, Burma, with a Sketch of Geology of Neighbourhood. Provisional list of Palæozoic and Mesozoic Fossils collected by Dr. Coggin Brown in Yunnan. Fall of three Meteoric Irons in Rajputana on 20th May 1921. Miscellaneous Note.

VOL. LVI, 1924-25.

Part 1.—General Report for 1923. Mineral Deposits of Burma.

Part 2.—Mineral Production of India during 1923. Soda rocks of Rajputana.

Part 3.—Gyrolite and Okenite from Bombay. Freshwater Fish from oil measures of Dawna Hills. Fossil Ampullariid from Poonch, Kashmir. Calcareous Alga belonging to Triploporellæ (Dasycladaceæ) from Tertiary of India. Froth Flotation of Indian Coals. Submarine Mud Eruptions off Arakan Coast, Burma. Cretaceous Fossils from Afghanistan and Khorasan.

Part 4.—Merua Meteorite. Stegodon Ganesa in Outer Siwaliks of Jammu. Land and Freshwater Fossil Molluscs from Karewas of Kashmir. Burmese Lignites from Namma, Lashio and Pauk. Maurypur Salt Works.

VOL. LVII, 1925.

Quinquennial Review of Mineral Production of India for 1919-1923.

VOL. LVIII, 1925-26.

Part 1.—General Report for 1924. Fossil Tree in Panchet Series of Lower Gondwanas near Asansol, with Palæontological Description.

Part 2.—Obituary: Francis William Walker. Possibilities of finding concealed coalfield at a workable depth in Bombay Presidency. Basalting Lavas penetrated by deep boring for coal at Bhusawal, Bombay Presidency.

Part 3.—Mineral Production of India during 1924. Enstatite Augite Series of Pyroxenes, Constitution of the Glauconite and Celadonite. Palagonite-bearing Dolerite from Nagpur.

Part 4.—Fossiles Crétacés de l'Afghanistan. Fossils du Kashmir et des Pamirs. Additions and Corrections to Vredenburg's Classification of the Cyprædæ. Petrology of Rocks from Girnar and Osham Hills, Kathiawar, India.

VOL. LIX, 1926.

Part 1.—General Report for 1925. Zonal distribution and description of larger foraminifera of middle and lower Kirthar series (middle eocene) of parts of Western India.

Part 2.—Sampling Operations in Panch Valley Coalfield. Composition of some Indian Garnets. Geology of Andaman and Nicobar Islands, with special reference to middle Andaman Island. Occurrence of Cryptohalite (Ammonium Fluosilicate). Remarks on Carter's Genus Cornulites-Dictyoconoides Nuttall with descriptions of some new Species from the Eocene of North-West India.

Contents and index to Records, Vols. I-XX and Vols. XXI-LV. Price 1 rupee each.

The price fixed for these publications is 1 rupee each part, or 2 rupees each volume of four parts, and the price of each part beginning with Volume LV is Rs. 2-12-0, or each volume of four parts, Rs. 11.

MISCELLANEOUS PUBLICATIONS.

A Manual of the Geology of India. 4 Vols. With map, 1879-1887—
Vol. 1. Peninsular Area. } By H. B. Medlicott and W. T. Blanford
Vol. 2. Extra Peninsular Area. } Price 6 rupees (*out of print*).
Vol. 3. Economic Geology. By V. Ball. Price 5 rupees (*out of print*).
Vol. 4. Mineralogy. By F. R. Mallet. Price 5 rupees (*out of print*).

A Manual of the Geology of India, 2nd edition. By R. D. Oldham (1893). Price 5 rupees (*out of print*).

A Manual of Geology of India, Economic Geology, by the late Prof. V. Ball, 2nd edition, revised in parts—
Part I.—Corundum. By T. H. Holland (1898). Price 1 rupee.

An introduction of the Chemical and Physical study of Indian Minerals. By T. H. Holland (1896). Price 3 annas (*out of print*).

Popular guides to the Geological collection in the Indian Museum, Calcutta—
No. 1. Tertiary vertebrate animals. By R. Lydekker (1879). Price 2 annas (*out of print*).
No. 2 Minerals. By F. R. Mallet (1879). Price 2 annas (*out of print*).
No. 3. Meteorites. By F. Fedden (1880). Price 2 annas (*out of print*).
No. 4. Palæontological collections. By O. Feistmantel (1881). Price 2 annas.
No. 5. Economic mineral products. By F. R. Mallet (1883). Price 2 annas (*out of print*).

A descriptive catalogue of the collection of minerals in the Geological Museum. By F. R. Mallet (1883). Price 1 rupee 8 annas.

Catalogue of the remains of Siwalik Vertebrata contained in the Geological Department of the Indian Museum By R. Lydekker Pt I. Mammalia (1885). Price 1 rupee. Part II. Aves, Reptilia, and Pisces (1886). Price 4 annas.

Catalogue of the remains of Pleistocene and Pre Historic Vertebrata contained in the Geological Department of the Indian Museum. By R. Lydekker (1886). Price 4 annas

Bibliography of Indian Geology. By R. D. Oldham (1888). Price 1 rupee 8 annas

Bibliography of Indian Geology By T. H. D. LaTouche—
Part I-A Bibliography (1917). Price 4 rupees.
Part I-B. Index of minerals of Economic Value (1918). Price 4 rupees.
Part II Index of Localities (1921). Price one rupee.
Part III. Index of Subjects (1923). Price 4 rupees.
Part IV. Palæontological Index (1926). Price 7 rupees 4 annas.

Report on the geological structure and stability of the hill slopes around Naini Tal. By T. H. Holland (1897). Price 3 rupees

Geological map of India, 1893. Scale 1″=96 miles Price 1 rupee (*out of print*).

Geological map of Tavoy district, Burma, 1919 Scale 1″=4 miles. Price 5 rupees.

Geological map of Bihar and Orissa, 1922 Scale 1″=16 miles. Price 5 rupees.

General Report for the period from 1st January 1897 to 1st April 1898. Price 1 rupee (*out of print*).

General Report for the year 1898-1899 Price 1 rupee (*out of print*)

General Report for the year 1899-1900. Price 1 rupee.

General Report for the year 1900-1901. Price 1 rupee.

General Report for the year 1901-1902. Price 1 rupee.

General Report for the year 1902-1903 Price 1 rupee.

Sketch of the Mineral Resources of India. By T. H. Holland (2908). Price 1 rupee (*out of print*).

Contents and index to Records, Vols. I-XX and Vols. XXI-XXX. Price 2 rupees each.

Contents and index to Memoirs, Vols. I-XX and Vols. XXI-XXX Price 1 rupee each.

Index to the Genera and Species described in the Palæontologia Indica, up to the year 1891 Price 1 rupee.

GEOLOGICAL SURVEY OF INDIA.

Director.

F. H. Pascoe, M.A., Sc.D. (Cantab.), D.Sc. (London), F.G.S., F.A.S.B.

Superintendents.

L. Leigh Fermor, O.B.E., A.R.S.M., D.Sc. (London), F.G.S., F.A.S.B., M.Inst.M.M. :
Guy E. Pilgrim, D.Sc. (London), F.G.S., F.A.S.B. :
G. H. Tipper, M.A. (Cantab.), F.G.S., F.A.S.B., M.Inst.M.M. :
G. de P. Cotter, B.A., Sc.D. (Dubl.), F.G.S., M.Inst.M.M., M.I.P.T. :
C. Coggin Brown, O.B.E. D.Sc. (Dunelm), F.G.S., F.A.S.B., M.I.M.E., M.Inst.M.M., M.I.E. (India) :
H. C. Jones, A.R.S.M., A.R.C.S., F.G.S.

Assistant Superintendents.

H. Walker, A.R.C.S., F.G.S., A.Inst.M.M. :
A. M. Heron, D.Sc. (Edin.), F.G.S., F.R.G.S., F.R.S.E. :
C. S. Fox, D.Sc. (Birm.), M.I.M.E., F.G.S. :
H. Crookshank, B.A., B.A.I. (Dub.) :
G. V. Hobson, B.Sc. (Lond.), A.R.S.M., D.I.C. (Lond.), M.A.I.M.E., A.Inst.M.M. :
E. L. G. Clegg, B.Sc. (Manch.). :
Rao Bahadur S. Sitho Rama Rao, B.A. (Madras), F.G.S. :
Rao Bahadur M. Vinayak Rao, B.A. (Madras), F.G.S. :
E. J. Bradshaw, B.A., B.A.I. (Dub.), F.G.S. :
L. Coulson, M.Sc. (Melb.), D.I.C., (Lond.), F.G.S. :
D. N. Wadia, M.A., B.Sc. (Bom.), F.G.S., F.R.G.S. :
J. A. Dunn, D.Sc. (Melb.), A.W.M.C., D.I.C. (Lond.), F.G.S. :
C. T. Barber, M.Sc. (Birm.), F.G.S. :
E. R. Gee, B.A. (Cantab.) : W. D. West, B.A. (Cantab.) : A. K. Banerji, B.A. (Cal.), A.R.C.S., F.G.S. :
M. S. Krishnan, M.A. (Madras), A.R.C.S., D.I.C., Ph.D. (London) :
P. Leicester, B.A. (Oxon.), F.G.S. : S. K. Chatterjee, M.Sc. (Calcutta), Ph.D., D.I.C. (London).

Chemist.

W. A. K. Christie, B.Sc. (Edin.), Ph.D., F.A.S.B., M.Inst.M.M. :

Artist.

K. F. Watkinson, F.R.P.S.

Sub-Assistants.

Bankey Bihari Gupta : Durgasankar Bhattacharji : Barada Charan Gupta : Harendra Mohan Lahiri, M.Sc. (Calcutta) : L. A. Narayana Iyer, M.A. (Madras) :
Phanindra Nath Mukerjee, B.S. (Calcutta).

Assistant Curator.

Purna Chandra Roy.

Head Clerk.

S. C. Banerji.

Geological Museum, Library and Office, Calcutta.

RECORDS

OF

THE GEOLOGICAL SURVEY OF INDIA,

VOL. LIX, PART 4.

1926.

CONTENTS.

Published by order of the Government of India.

CALCUTTA: GOVERNMENT OF INDIA
CENTRAL PUBLICATION BRANCH
1927

Price Rs. 2-12 or 4s

MEMOIRS OF THE GEOLOGICAL SURVEY OF INDIA.

VOL. I. Pt. 1, 1856 (*out of print*) (*price* 1 Re.): Coal and Iron of Talchir.—Talcnir Coal-field.—Gold yielding deposits of Upper Assam.—Gold from Shué-gween. Pt. 2, 1858 (*out of print*) (*price* 2 Rs.): Geological structure of a portion of Khasi Hills.—Geological structure of Nilgiri Hills (Madras). Pt. 3, 1859 (*out of print*) (*price* 2 Rs.): Geological structure and physical features of districts of Bankura, Midnapore, and Orissa.—Laterite of Orissa.—Fossil fish-teeth of genus *Ceratodus*, from Maledi, south of Nagpur.

VOL. II. Pt. 1, 1859 (*out of print*) (*price* 2 Rs.): Vindhyan rocks, and their associates in Bundelkhand. Pt. 2, 1860 (*out of print*) (*price* 3 Rs.): Geological structure of central portion of Nerbudda District.—Tertiary and alluvial deposits of central portion of Nerbudda Valley.—Geological relations and probable age of systems of rocks in Central India and Bengal.

VOL. III. Pt. 1, 1861 (*out of print*) (*price* 3 Rs.): Raniganj Coal-field.—Additional remarks on systems of rocks in Central India and Bengal.—Indian Mineral Statistics, I. Coal. Pt. 2, 1864 (*out of print*) (*price* 2 Rs.): Sub-Himalayan Ranges between Ganges and Ravi.

VOL. IV. Pt. 1, 1862 (*out of print*) (*price* 2 Rs.): Cretaceous Rocks of Trichinopoly District, Madras. Pt. 2, 1864 (*out of print*) (*price* 2 Rs.): Districts of Trichinopoly, Salem, etc. Pt. 3, 1865 (*out of print*) (*price* 1 Re.): Coal of Assam, etc.

VOL. V. Pt. 1, 1865 (*out of print*) (*price* 5 Rs.): Sections across N.-W. Himalaya, from Sutlej to Indus.—Gypsum of Spiti. Pt. 2, 1866 (*out of print*) (*price* 1 Re.): Geology of Bombay. Pt. 3, 1866 (*out of print*) (*price* 1 Re.): Jheria Coal-field.—Geological Observations on Western Tibet.

VOL. VI. Pt. 1, 1867 (*price* 8 As.): Neighbourhood of Lynyan, etc., in Sind.—Geology of portion of Cutch. Pt. 2, 1867, Rep. 1868 and 1921 (*price* 2 Rs.): Bokaro Coal-field.—Ramgarh Coal-field. Traps of Western and Central India. Pt. 3. 1869 (*price* 2 Rs. 8 As.): Tapti and Nerbudda Valleys. Frog beds in Bombay.—*Oxyglossus pusillus*.

VOL. VII. Pt. 1, 1869 (*price* 3 Rs.): Vindhyan series.—Mineral Statistics: Coal.—Shillong Plateau. Pt. 2, 1869 (*out of print*) (*price* 1 Re.) Kathaiani Coal-field.—Deoghar Coal-field. Pt. 3, 1871 (*out of print*) (*price* 1 Re.): Aden Water supply.—Karanpura Coal-fields.

VOL. VIII. Pt. 1, 1872 (*price* 1 Re.): Kaladgi and Karnul formations in Madras Presidency. Pt. 2, 1872 (*out of print*) (*price* 1 Re.): Ikkhuri Coal-field.—Dalhousie Coal-field.—Cutch Coal-field.

VOL. IX. Pt. 1, 1872 (*price* 1 Re.): Geology of Kutch. Pt. 2, 1872 (*price* 1 Re.): Geology of Nagpur.—Geology of Sirban Hill.—Carboniferous Ammonites.

VOL. X. Pt. 1, 1873 (*price* 3 Rs.). Geology of Madras.—Sátpura Coal-basin. Pt. 2, 1873 (*out of print*) (*price* 2 Rs.): Geology of Pegu.

VOL. XI. Pt. 1, 1874 (*price* 2 Rs.): Geology of Dárjiling and Western Duars. Pt. 2, 1875 (*price* 3 Rs.): Salt-region of Kohat, Trans-Indus.

VOL. XII. Pt. 1, 1876 (*price* 3 Rs.): South Mahratta Country. Pt. 2, 1876 (*price* 2 Rs.): Coal fields of Nága Hills.

VOL. XIII. Pt. 1, 1877 (*price* 2 Rs. 8 As.): Wardha Valley Coal field. Pt. 2, 1877 (*price* 2 Rs. 8 As.): Geology of Rajmahál Hills.

VOL. XIV. 1878 (*price* 5 Rs.): Geology of Salt range in Punjab.

VOL. XV. Pt. 1, 1878 (*out of print*) (*price* 2 Rs. 8 As.): Aurunga and Hutár Coal-fields (Palamow). Pt. 2, 1880 (*price* 2 Rs. 8 As.): Ramkola and Tatapani Coal-fields (Sirguja).

VOL. XVI. Pt. 1, 1879 (*price* 1 Re. 8 As.): Geology of Eastern Coast from Lat. 15° to Masulipatam. Pt. 2, 1880 (*price* 1 Re. 8 As.): Nellore Portion of Carnatic. Pt. 3. 1880 (*price* 2 Rs.): Coastal Region of Godávari District.

VOL. XVII. Pt. 1, 1879 (*price* 3 Rs.) : Geology of Western Sind. Pt. 2, 1886 (*price* 2 Rs.) : Trans-Indus extension of Punjab Salt range.

VOL. XVIII. Pt. 1, 1881 (*out of print*) (*price* 2 Rs.) : Southern Afghanistan. Pt. 2, 1881 (*out of print*) (*price* 1 Re. 8 As.) : Manbhum and Singhbhûm Pt. 3, 1881 (*out of print*) (*price* 2 Rs.) : Prânhita-Godavâri Valley.

VOL. XIX. Pt. 1, 1882 (*price* 2 Rs.) : Cachar Earthquake of 1869. Pt. 2. 1882 (*out of print*) (*price* 1 Re.) : Thermal Springs of India. Pt. 3, 1883 (*price* 1 Re.) : Catalogue of Indian Earthquakes. Pt. 4, 1883 (*out of print*) (*price* 1 Re.) : Geology of parts of Manipur and Naga Hills.

VOL. XX. Pt. 1, 1883 (*out of print*) (*price* 2 Rs. 8 As.) : Geology of Madura and Tinnevelly. Pt. 2, 1883 (*out of print*) (*price* 2 Rs 8 As.) : Geological notes on Hills in neighbourhood of Sind and Punjab Frontier between Quetta and Dera Ghazi Khan.

VOL. XXI. Pt. 1, 1884 (*out of print*) (*price* 2 Rs.) : Geology of Lower Narbada Valley. Pt. 2. 1885 (*out of print*) (*price* 1 Re.) : Geology of Kathiawar. Pt. 3, 1885, Rep. 1925 (*price* 6 Rs. 14 As.) : Coal-fields of South Rewah. Pt. 4, 1885 (*out of print*) (*price* 1 Re.) : Barren Island.

VOL. XXII. 1883 (*out of print*) (*price* 5 Rs.) : Geology of Kashmir, Chamba and Khagan.

VOL. XXIII. 1891 (*price* 5 Rs.) : Geology of Central Himalayas.

VOL. XXIV. Pt. 1, 1887 (*price* 1 Re. 8 As.) : Southern Coal fields of Sátpur Gondwána basin. Pt. 2, 1890 (*out of print*) (*price* 2 Rs. 4 As.) : Geology of Sub Himalaya of Garhwal and Kumaon. Pt. 3, 1990 (*out of print*) (*price* 1 Re. 4 As.) : Geology of South Malabar, between Beypore and Ponnâni Rivers

VOL. XXV. 1895 (*out of print*) (*price* 5 Rs.) : Geology of Bellary District, Madras Presidency.

VOL. XXVI. 1896 (*out of print*) (*price* 5 Rs.) : Geology of Hazara.

VOL. XXVII. Pt. 1, 1895 (*out of print*) (*price* 1 Re.) : Marine Fossils from Miocene of Upper Burma. Pt. 2, 1897 (*out of print*) (*price* 4 Rs.) : Petroleum in Burma and its technical exploitation.

VOL. XXVIII. Pt. 1, 1896 (*out of print*) (*price* 2 Rs.) : Geological Structure of Chitichun region.—Allahbund in north-west of Rann of Kuchh.—Geology of parts of Myingyan, Magwe and Pakokku Districts, Burma —Geology of Mikir Hills in Assam.—Geology of Tirah and Bazar Valley. Pt. 2, 1900 (*price* 1 Rs.) Charnockite Series group of Archæan Hypersthenic Rocks in Peninsular India.

VOL. XXIX. 1900 (*price* 5 Rs.) : Earthquake of 12th June 1897.

VOL. XXX. Pt. 1, 1900 (*price* 2 Rs.) : Aftershocks of Great Earthquake of 12th June 1897. Pt. 2, 1900 (*price* 1 Re.) : Geology of neighbourhood of Salem, Madras Presidency. Pt. 3, 1901 (*price* 1 Re.) : Sivamalai Series of Elæolite Syenites and Corundum Syenites. Pt 4. 1901.

VOL. XXXI Pt. 1, 1901 (*out of print*) (*price* 2 Rs.) : Geology of Son Valley in Rewah State and of Parts of Jabalpur and Mirzapur. Pt 2, 1902 (*price* 3 Rs.) : Baluchistan Desert and part of Eastern Persia. Pt. 3, 1901 (*price* 1 Re.) : Peridotites, Serpentines, etc., from Ladakh.

VOL. XXXII. Pt. 1, 1901 (*price* 1 Re.) : Recent Artesian Experiments in India. Pt 2, 1901 (*price* 2 Rs.) : Rampur Coal-field. Pt. 3, 1902 (*price* 3 Rs.) : "Exotic Blocks" of Malla Johar in Bhot Mahals of Kumaon. Pt. 4, 1904 (*price* 3 Rs.) : Jammu Coal fields

VOL. XXXIII. Pt. 1, 1901 (*price* 8 Rs.) : Kolar Gold-field. Pt. 2, 1901 (*price* 2 Rs.) : Art 1 : Gold fields of Wynad Art 2 Auriferous Quarters of Padhidiah, Chota Nagpur. Art 3 : Auriferous localities in North Coimbatore. Pt. 3, 1902 (*price* 1 Re.) : Geology of Kalahandi State, Central Provinces

VOL. XXXIV. Pt. 1, 1901 (*price* 1 Re.) : Peculiar form of altered Peridotite in Mysore State. Pt. 2, 1902 (*out of print*) (*price* 3 Rs.) : Mica deposits of India. Pt. 3, 1903 (*price* 1 Re.) : Sandhills of Clifton near Karachi. Pt. 4, 1908 (*price* 4 As.) : Geology of Persian Gulf and adjoining portions of Persia and Arabia.

VOL. XXXV. Pt. 1, 1902 (*out of print*) (*price* 2 Rs.) : Geology of Western Rajputana. Pt. 2, 1903 (*price* 1 Re.) : Aftershocks of Great Earthquake of 12th June 1897. Pt. 3, 1904 (*out of print*) (*price* 1 Re.) : Seismic phenomena in British India and their connection with its Geology. Pt. 4, 1911 (*price* 1 Re) : Geology of Andaman Islands, with reference to Nicobars.

VOL. XXXVI. Pt. 1, 1904 (*price* 4 Rs.) : Geology of Spiti. Pt. 2, 1907 (*price* 3 Rs.) : Geology of Provinces of Tsang and U in Central Tibet Pt 3, 1919 (*price* 3 Rs.) : Trias of the Himalayas.

Vol XXXVII 1909 (*price of complete volume* 8 Rs) Manganese Ore Deposits of India. Pt 1 (*out of print*) (*price* 3 Rs.), Introduction and Mineralogy, Pt 2 (*out of print*) (*price* 3 Rs), Geology; Pt 3 (*out of print*) (*price* 3 Rs), Economics and Mining; Pt. 4 (*out of print*) (*price* 5 Rs.) Description of Deposits

Vol XXXVIII 1910 (*price* 5 Rs) Kangra Earthquake of 4th April 1905

Vol XXXIX Pt 1 1911 (*price* 2 Rs) Geology of Northern Afghanistan Pt 2, 1913 (*price* 3 Rs) Geology of Northern Shan States

Vol XL Pt 1, 1912 (*out of print*) (*price* 5 Rs) Oil Fields of Burma Pt 2, 1914 (*price* 3 Rs). Petroleum Occurrences of Assam and Bengal Pt 3, 1920 (*out of print*) (*price* 5 Rs): Petroleum in the Punjab and North West Frontier Province

Vol XLI Pt 1, 1913 Rep 1922 (*price* 5 Rs) Coal fields of India Pt 2 1914 (*price* 3 Rs) Geology and Coal Resources of Korea State, Central Provinces

Vol XLII Pt 1 1914 (*price* 3 Rs) Burma Earthquakes of May 1912 Pt 2 1917 (*price* 3 Rs) The structure of the Himalayas and the Gangetic Plain

Vol XLIII Pt 1, 1913 (*out of print*) (*price* 2 Rs) Indian Geological Terminology Pt 2 1916 (*price* 1 Re). Catalogue of Meteorites in the collection of the Geological Survey of India, Calcutta

Vol XLIV. Pt. 1, 1921 (*price* 5 Rs): Geology of Idar State. Pt. 2, 1923 (*price* 6 Rs. 8 As): Geology and Ore Deposits of Tavoy

Vol XLV Pt 1, 1917 (*price* 3 Rs): Geology of North Eastern Rajputana and adjacent districts Pt 2, 1922 (*price* 3 Rs): Gwalior and Vindhyan Systems in South Eastern Rajputana

Vol XLVI Pt 1, 1920 (*price* 3 Rs) Shillong Earthquake of 8th July 1918 Pt 2, 1926 (*price* 2 Rs) The Cutch (Kachh) Earthquake of 16th June 1819 with a Revision of the Great Earthquake of 12th June 1897.

Vol XLVII Pt 1, 1920 (*price* 5 Rs) · Mines and Mineral Resources of Yunnan Pt 2, 1923 (*price* 4 Rs) The Alkaline Lakes and the Salt Industry of Sind

Vol XLVIII Pt 1 1922 (*price* 5 Rs) Geological Notes on Mesopotamia with special references to Occurrences of Petroleum Pt 2, 1925 (*price* 3 Rs 12 As) Geology of Parts of the Persian Provinces of Fars, Kerman and Laristan

Vol XLIX Pt 1 1927 (*price* 3 Rs 8 As) The Pyroxite and Aluminous Laterite occurrences of India Pt 2 (*in the press*) The Former Glaciation of the East Indian Valley Kashmir

Vol L Pt 1 1925 (*price* 5 Rs 6 As) · Descriptions of Mollusca of the Post Cretaceous Tertiary formations of North Western India

Vol LI Pt 1 1926 (*price* 3 Rs 8 As) Indian Geological Terminology Pt 2 (*in the press*) The Geology of Portion of Persian State (Kashmir) and Adjacent Portions of the Punjab

Vol LII Pt 1, 1925 (*price* 7 Rs 8 As): On the Geological Structure of the Karanpura Coalfields, Bihar and Orissa

Contents and index to Memoirs, Vols I XX and Vols XXI XXXV Price 1 rupee each

PALÆONTOLOGIA INDICA.

(Ser. I, III, V, VI, VIII.)—CRETACEOUS FAUNA OF SOUTHERN INDIA, F. STOLICZKA, *except* Vol. I, Pt. 1, *by* H. F. BLANFORD.

Ser. I & III.—Vol. I. The Cephalopoda (1861—65), pp. 216, pls. 94 (6 double) (*out of print*).

V.—Vol. II. The Gastropoda (1867—68), pp. xiii, 500, pls. 28 (*out of print*).

VI.—Vol. III. The Pelecypoda (1870—71), pp. xxii, 537, pls. 50.

VIII.—Vol. IV. The Brachiopoda, Ciliopoda, Echinodermata, Corals, etc. (1872—73), pp. v, 202, pls. 29.

(Ser. II, XI, XII.)—THE FOSSIL FLORA OF THE GONDWANA SYSTEM, *by* O. FEISTMANTEL, *except* Vol. I, Pt. 1, *by* T. OLDHAM and J. MORRIS.

Vol. I, pp. xviii, 233, pls. 72. 1863-79. Pt. 1 (*out of print*): Rájmahál Group, Rajmahal Hill. Pt. 2: *The same* (*continued*). Pt. 3: Plants from Golapilli. Pt. 4: Outliers on the Madras Coast.

Vol. II, pp. xli, 115, pls. 26. 1876-78. Pt. 1: Jurassic Flora of Kach. Pt. 2: Flora of the Jabalpur group.

Vol. III, pp. xi, 64+149, pls. 60 (9 double) (I—XXXI+IA—XLVIIA). 1879-81. Pt. 1: The Flora of the Talchir-Karharbari beds. Pt. 2: The Flora of the Damuda and Panchet Divisions. Pt. 3: *The same* (*concluded*).

Vol. IV, pp. xxv., 25+66, pls. 35 (2 double) (I—XXI+IA—XIVA). Pt. 1 (1882) (*out of print*): Fossil Flora of the South Rewah Gondwana basin. Pt. 2 (1886): Fossil Flora of some of the coal-fields in Western Bengal

(Ser. IX.)—JURASSIC FAUNA OF KUTCH.

Vol. I (1873-76). The Cephalopoda, pp. i, 247, pls. 60 (6 double), by W. Waagen.

Vol. II, pt. 1 (1893). The Echinoidea of Kach, pp. 12, pls. 2, by J. W. Gregory (*out of print*).

Vol. II, pt. 2 (1900). The Corals, pp. 196, I—IX, pls. 26, by J. W. Gregory.

Vol. III, pt. 1 (1900). The Brachiopoda, pp. 87, pls. 15, by F. L. Kitchin.

Vol. III, pt. 2 (1903). Lamellibranchiata: Genus Trigonia, pp. 122, pls. 10, by F. L. Kitchin.

(Ser. IV.)—INDIAN PRE-TERTIARY VERTEBRATA.

Vol. I, pp. vi, 137, pls. 26. 1865-85. Pt. 1 (1865): The Vertebrate Fossils from the Panchet rocks, by T. H. Huxley. Pt. 2 (1878): The Vertebrate Fossils of the Kota-Maleri Group, by Sir P. de M. Grey Egerton, L. C. Miall, and W. T. Blanford. Pt. 3 (1879): Reptilia and Batrachia, by R. Lydekker. Pt. 4 (1885): The Labyrinthodont from the Bijori group, by R. Lydekker. Pt. 5 (1885): The Reptilia and Amphibia of the Maleri and Denwa groups, by R. Lydekker.

(Ser. X.)—INDIAN TERTIARY AND POST-TERTIARY VERTEBRATA, *by* R. LYDEKKER, *except* Vol. I, Pt. 1, *by* R. B. FOOTE.

Vol. I, pp. xxx, 300, pls. 50. 1874-80. Pt. 1: Rhinoceros deccanensis. Pt. 2: Molar teeth and other remains of Mammalia. Pt. 3: Crania of Ruminants Pt. 4: Supplement to Pt. 3. Pt. 5: Siwalik and Narbada Proboscidia.

Vol. II, pp. xv, 363, pls. 1881-84. Pt. 1: Siwalik Rhinocerotidæ. Pt. 2: Supplement to Siwalik and Narbada Proboscidia. Pt. 3: Siwalik and Narbada Equidæ. Pt. 4: Siwalik Camelopardalidæ. Pt. 5: Siwalik Selenodont Suina, etc. Pt. 6: Siwalik and Narbada Carnivora.

Vol. III, pt. xxiv, 264, pls. 1884-86. Pt. 1 (*out of print*): Additional Siwalik Perissodactyla and Proboscidia. Pt. 2 (*out of print*): Siwalik and Narbada Bunodont Suina. Pt. 3 (*out of print*): Rodents and new Ruminants from the Siwaliks. Pt. 4 (*out of print*): Siwalik Birds. Pt. 5 (*out of print*): Mastodon Teeth from Perim Island. Pt. 6 (*out of print*): Siwalik and Narbada Chelonia. Pt. 7 (*out of print*): Siwalik Crocodilia, Lacertilia and Ophidia. Pt. 8 (*out of print*): Tertiary Fishes.

Vol. IV, pt. 1 (*out of print*), 1886, pp. 18, pls. 6. Siwalik Mammals (Supplement).

Vol. IV, pt. 2 (*out of print*), 1886, pp. 40 (19—58), pls. 5 (vii—xi), The Fauna of the Karnul caves (and addendum to pt. 1).

Vol. IV, pt. 3 (*out of print*), 1887, pp. 7 (59-65), pls. 2 (xii—xiii). Eocene Chelonia from the Salt-range.

(Ser. VII. XIV.)—TERTIARY AND UPPER CRETACEOUS FAUNA OF WESTERN INDIA, *by* P. MARTIN DUNCAN *and* W. PERCY SLADEN, *except* Pt. 1, *by* F. STOLICZKA.

Vol. I, pp. 16+110+332+81=599, pls. 5+28+58+13=104. 1871-85. Pt. 1 (*out of print*): Tertiary Crabs from Sind and Kach. Pt. 1 (new 2): Sind Fossil Coral and Alcyonaria, by P. Martin Duncan. Pt. 3: The Fossil Echinoidea of Sind: *Fas. 1, The Cardita beaumonti* beds; *Fas. 2*, The Ranikot Series in Western Sind; *Fas. 3*, The Khirthar Series; *Fas. 4*, The Nari (Oligocene) Series; *Fas. 5*, The Gaj (Miocene) Series; *Fas. 6*, The Makran (Pliocene) Series; by Duncan and Sladen. Pt. 4: The Fossil Echinoidea of Kach and Kattywar, by Duncan, Sladen and Blanford.

(Ser. XIII.)—SALT-RANGE FOSSILS, *by* WILLIAM WAAGEN, Ph.D.

Productus Limestone Group: Vol. I, Pt. 1 (1879). Pisces, Cephalopoda, pp. 72, pls. 6.

" " " " 2 (1880). Gastropoda and supplement to pt. 1, pp. 111 (73—183), pls. 10 (1 double), (vii—xvi).

" " " " 3 (1881). Pelecypoda, pp. 144 (185-328), pls. 8 (xvii—xxiv).

" " " " 4 (1882—85). Brachiopoda, pp. 442 (329—770), pls. 62 (xxv—lxxxvi).

" " " " 5 (1885). Bryozoa—Annelida—Echinodermata, pp. 64 (771—834), pls. 10 (lxxxvii—xcvi).

" " " " 6 (1886). Cœlenterata, pp. 90 (835—924), pls. 20 (xcvii—cxvi).

" " " 7 (1887). Cœlenterata, Protozoa, pp. 74 (925-998), pls. 12 (cxvii—cxxviii).

Fossil Flora of the Gondwana Formation: Vol. II, pt. 1 (1895). Pisces—Ammonoidea, pp. 304, pl. 40 (*out of print*).

Geological Results: Vol. IV, pt. 1 (1889), pp. 1—88, pls. 4 (*out of print*).

" " " " 2 (1891) pp. 89—242, pls. 8

(Ser. XV.)—HIMALAYAN FOSSILS.

Upper triassic and hassic fauna of the exotic blocks of Malla Johar in the Bhot Mahal. of Kumaon: Vol. I, pt. 1 (1908), pp. 100, pls. 16 (1 double), by Dr. C. Diener.

Anthracolithic Fossils of Kashmir and Spiti: Vol. I, pt. 2 (1899), pp. 96, pls. 8, by Dr. C. Diener.

The Permocarboniferous Fauna of Chitichun No. I: Vol. I, pt. 3 (1897), pp. 105, pls. 13, by Dr. C. Diener.

The Permian Fossils of the Productus Shales of Kumaon and Garhwal: Vol. I, pt. 4 (1897), pp. 54, pls. 5, by Dr. C. Diener.

The Permian Fossils of the Central Himalayas: Vol. I, pt. 5 (1903), pp. 204, pls. 10, by Dr. C. Diener.

The Cephalopoda of the Lower Trias: Vol. II, pt. 1 (1897), pp. 182, pls. 23, by Dr. C. Diener.

The Cephalopoda of the Muschelkalk: Vol. II, pt. 2 (1895), pp. 118, pls. 31, by Dr. C. Diener.

Upper Triassic Cephalopoda Faunæ of the Himalaya: Vol. III, pt. 1 (1899), pp. 157, pls. 22 by Dr. E. von Mojsisovics.

Trias Brachiopoda and Lamellibranchiata: Vol. III, pt. 2 (1899), pp. 76, pls. 12 (2 double), by Alexander Bittner.

The Fauna of the Spiti Shales : Vol. IV. Cephalopoda : Fasc. 1 (1903), pp. 132, pls. 18; Fasc. 2 (1910), pp. 133—306, pls. 47 (2 double); Fasc. 3 (1910), pp. 307—395, pls. 32; by Dr. V. Uhlig. Lamellibranchiata and Gastropoda : Fasc. 4 (1913), pp. 397—456, pls. 7; by Dr. K. Holdhaus. Additional Notes on the Fauna of the Spiti Shales : Fasc. 5 (1914), pp. 457—511, pls. 4; by Miss Paula Steiger, Ph.D.

The Fauna of the Tropites-Limestone of Byans : Vol. V, Memoir No. 1 (1906), pp. 201, pls. 17 (1 double), by Dr. C. Diener.

The Fauna of the Himalayan Muschelkalk : Vol. V, Memoir No. 2 (1907), pp. 140, pls. 17 (2 double), by Dr. C. Diener.

Ladinic, Carnic and Noric faunæ of Spiti : Vol. V, Memoir No. 5 (1908), pp. 157, pls. 24 (3 double), by Dr. C. Diener.

Lower Triassic Cephalopoda from Spiti, Malla Johar and Byans : Vol. VI, Memoir No. 1 (1909), pp. 186, pls. 31, by Drs. A. von Kraft and C. Diener.

The Fauna of the Traumatocrinus Limestone of Painkhanda : Vol. VI, Memoir No. 2 (1909), pp. 39, pls. 5, by Dr. C. Diener.

The Cambrian Fossils of Spiti : Vol. VII, Memoir No. 1 (1910), pp. 70, pls. 6, by F. R. C. Reed.

Ordovician and Silurian fossils from the Central Himalayas : Vol. VII, Memoir No. 2 (1912), pp. 160, pls. 20, by F. R. C. Reed.

(Ser. XVI.)—BALUCHISTAN FOSSILS, *by* FRITZ NOETLING, Ph.D., F.G.S.

The Fauna of the Kellaways of Mazar Drik : Vol. I pt. 1 (1895), pp. 22, pls. 15.

The Fauna of the (Neocomian) Belemnite Beds : Vol. I. pt. 2 (1897), pp. 6, pls. 2.

The Fauna of the Upper Cretaceous (Maestrichtien) Beds of the Mari Hills : Vol. I, pt. 3 (1897), pp. 79, pls. 23.

The price fixed for these publications is four annas per single plate, with a minimum charge of Re. 1.

(NEW SERIES.)

The Cambrian Fauna of the Eastern Salt-range : Vol. I, Memoir 1 (1899), pp. 14, pl. 1, by K. Redlich. Price 1 Re.

Notes on the Morphology of the Pelecypoda : Vol. I, Memoir 2 (1899), pp. 58, pls. 4, by Dr. Fritz Noetling. Price 1 Re. 4 As.

Fauna of the Miocene Beds of Burma : Vol. I, Memoir 3 (1901), pp. 378, pls. 25, by Dr. Fritz Noetling. Price 6 Rs. 4 As. (*out of print*).

Observations sur quelques Plantes Fossiles des Lower Gondwanas : Vol. II, Memoir 1 (1902), pp. 39, pls. 7, by R. Zeiller. Price 1 Re. 12 As.

Permo-Carboniferous Plants and Vertebrates from Kashmir : Vol. II, Memoir No. 2 (1905), pp. 13, pls. 3, by A. C. Seward and Dr. A. Smith Woodward. Price 1 Re.

The Lower Palæozoic Fossils of the Northern Shan States, Upper Burma : Vol. II, Memoir No. 3 (1906), pp. 154, pls. 8, by F. R. C. Reed. Price 2 Rs.

The Fauna of the Napeng Beds or the Rhætic Beds of Upper Burma : Vol. II, Memoir No. 4 (1908), pp. 88, pls. 9, by Miss M. Healey. Price 2 Rs. 4 As.

The Devonian Faunas of the Northern Shan States : Vol. II, Memoir No. 5 (1908), pp. 183, pls. 20, by F. R. C. Reed. Price 5 Rs.

The Mollusca of the Ranikot Series : Vol. III, Memoir No. 1 (1909), pp. xix, 83, pls. 8, by M. Cossman and G. Pissarro. Introduction, by E. W. Vredenburg. Price 2 Rs.

The Brachiopoda of the Namyau Beds, Northern Shan States, Burma : Vol. III, Memoir No. 2 (1917), pp. 254, pls. 21, by S. S. Buckman. Price 5 Rs. 4 As.

On some Fish remains from the Beds of Dongargaon, Central Provinces : Vol. III, Memoir No. 3 (1908), pp. 6, pl. 1, by Dr. A. Smith Woodward. Price 1 Re.

Anthracolithic Fossils of the Shan States : Vol. III, Memoir No. 4 (1911), pp. 74, pls. 7, by Dr. C. Diener. Price 1 Re. 12 As.

The Fossil Giraffidæ of India : Vol. IV, Memoir No. 1 (1911), pp. 29, pls. 5, by Dr. G. E. Pilgrim. Price 1 Re. 4 As.

The Vertebrate Fauna of the Gaj Series in the Bugti Hills and the Punjab : Vol. IV, Memoir No. 2 (1912), pp. 83, pls. 30, and map, by Dr. G. E. Pilgrim. Price 8 Rs.

Lower Gondwana Plants from the Golabgarh Pass, Kashmir : Vol. IV, Memoir No. 3 (1912), pp. 10, pls. 3, by A. C. Seward. Price 1 Re.

Mesozoic Plants from Afghanistan and Afghan-Turkistan : Vol. IV, Memoir No. 4 (1912), pp. 57, pls. 7 by A. C. Seward. Price 1 Re. 12 As.

Triassic Faunæ of Kashmir : Vol. V, Memoir No. 1 (1913), pp. 133, pls. 13, by Dr. C. Diener. Price 3 Rs. 4 As.

The Anthracolithic Faunæ of Kashmir, Kanaur and Spiti : Vol. V, Memoir No. 2 (1915), pp. 135, pls. 11, by Dr. C. Diener. Price 2 Rs. 12 As.

Le Crétacé at l'Eocéne du Tibet Central : Vol. V, Memoir No. 3 (1916), pp. 52, pls. 16, by Prof. Henri Douvillé. Price 4 Rs.

Supplementary Memoir on New Ordovician and Silurian fossils from the Northern Shan States : Vol. VI, Memoir No. 1 (1915), pp. 98, pls. 12, by F. R. C. Reed. Price 3 Rs.

Devonian Fossils from Chitral and the Pamirs : Vol. VI, Memoir No. 2 (1922), pp. 136, pls. 16, by F. R. C. Reed. Price 4 Rs.

Ordovician and Silurian Fossils from Yunnan : Vol. VI, Memoir No. 3 (1917), pp. 69, pls. 8, by F. R. C. Reed. Price 2 Rs.

Upper Carboniferous Fossils from Chitral and the Pamirs : Vol. VI, Memoir No. 4 (1925), pp. 134, pls. 10, by F. R. C. Reed. Price 9 Rs. 13 As.

Indian Gondwana Plants : A Revision : Vol. VII, Memoir No. 1 (1920), pp. 41, pls. 7, by A. C. Seward and B. Sahni. Price 1 Re. 12 As

The Lamellibranchiata of the Eocene of Burma, Vol. VII, Memoir No. 2 (1923), pp. 24, pls. 7, by Dr. G. de P. Cotter. Price 3 Rs. 10 As.

A Review of the Genus Gisortia with descriptions of several Species : Vol. VII, Memoir No 3 (1927) pp 78. pls 32, by E Vredenburg Price 10 Rs. 5 As.

An incomplete skull of Dinotherium with notes on the Indian forms : Vol. VII, Memoir No. 4 (1924), pp. 13. pls. 3, by R. W. Palmer. Price 1 Re. 2 As.

Contributions to the Palæontology of Assam : Vol. VIII, Memoir No. 1 (1923), pp. 73, pls. 4, by Erich Spengler. Price 5 Rs.

The Anthracotheriidæ of the Dera Bugti deposits in Baluchistan : Vol. VIII, Memoir No. 2 (1924), pp. 59, pls. 7, by C. Forster Cooper. Price 4 Rs.

The Perissodactyla of the Eocene of Burma : Vol. VIII, Memoir No. 3 (1925), pp. 28 pls. 2, by Dr. G. E. Pilgrim. Price 1 Re. 9 As.

The Fossil Suidæ in India : Vol. VIII, Memoir No. 4 (1926), pp. 65, pls. 20, by Dr. G. E. Pilgrim. Price 11 Rs 12 As

On the Blake Collection of Ammonites from Kachh : Vol. IX, Memoir No. 1 (1924), pp 29, by L. F. Spath. Price 12 As.

Revision of the Jurassic Cephalopod Fauna of Kachh (Cutch) Part 1 : Vol. IX, Memoir No. 2 (1927) pp. 71. pls. 7, by L. F Spath Price 4 Rs. 12 As.

Revision of the Jurassic Cephalopod Fauna from Kachh (Cutch) Part 2 : Vol. IX, Memoir No 3 (*in the press*) by L. F. Spath.

Palæozoic and Mesozoic Fossils from Yunnan : Vol. X, Memoir No. 1 (*in the press*), by F. R. C. Reed.

The Mollusca of the Ranikot Series (together with some species from the Cardita Beaumonti Beds : Vol X, Memoir 2 (*in the press*), by M. Cossmann and G. Pissaro. Revised by the late Mr. E. Vredenburg, with an introduction and editorial notes by Dr. G. de P. Cotter

Index to the Genera and Species described in the Palæontologia Indica, up to the year 1891. Price 1 rupee.

Les Couches a Cardita Beaumonti dans le Beloutchistan : Vol. X, Memoir No 3 (*in the press*), by Prof Henri Douvillé.

A Supplement to the Mollusca of the Ranikot Series Vol X. Memoir No. 4 (*in the press*), by E W. Vredenburg edited with notes by Dr G de P Cotter.

Revisions of Indian Fossil Plants I Coniferales (a Impressions and Incrustations) : Vol XI. (*in the press*) by Prof B Sahni.

The Fauna of the Agglomeratic Slate Series of Kashmir : Vol. XII (*in the press*), by H. S Bion

The Artiodactyla of the Eocene of Burma . Vol XIII (*in the press*), by Dr. G. E. Pilgrim.

A Sivapithecus Palate and other Primate Fossils from India . Vol. XIV (*in the press*), by Dr G. E Pilgrim

RECORDS OF THE GEOLOGICAL SURVEY OF INDIA.

Vol. I, 1868.

Part 1 (out of print).—Annual report for 7867. Coal-seams of Tawa valley. Coal in Garrow Hills. Copper in Bundelkund. Meteorites.

Part 2 (out of print).—Coal-seams of neighbourhood of Chanda. Coal near Nagpur. Geological notes on Surat Collectorate. Cephalopodous fauna of South Indian cretaceous deposits. Lead in Raipur district. Coal in Eastern Hemisphere Meteorites.

Part 3 (out of print).—Gastropodous fauna of South Indian cretaceous deposits. Notes on route from Poona to Nagpur *viâ* Ahmednuggur, Jalna, Loonar, Yeotmahal, Mangali and Hingunghat. Agate-flake in pliocene (?) deposits of Upper Godavery Boundary of Vindhyan series in Rajputana. Meteorites.

Vol. II, 1869.

Part 1 (out of print).—Valley of Poorna river, West Berar. Kuddapah and Kurnool formations. Geological sketch of Shillong plateau. Gold in Singhbhoom, etc Wells at Hazareebagh. Meteorites.

Part 2 (out of print).—Annual report for 1868. Pangshura tecta and other species of Chelonia from newer tertiary deposits of Nerbudda valley. Metamorphic rocks of Bengal.

Part 3 (out of print).—Geology of Kutch, Western India. Geology and physical geography of Nicobar Islands.

Part 4 (out of print).—Beds containing silicified wood in Eastern Prome, British Burma. Mineralogical statistics of Kumaon division. Coal-field near Chanda. Lead in Raipur district. Meteorites

Vol. III, 1870.

Part 1 (out of print).—Annual report for 1869. Geology of neighbourhood of Madras. Alluvial deposits of Irrawadi, contracted with those of Ganges.

Part 2 (out of print).—Geology of Gwalior and vicinity. States at Chiteli, Kumaon. Lead vein near Chicholi, Raipur district. Wardha river coal-fields, Berar and Central Provinces. Coal at Karba in Bilaspur district.

Part 3 (out of print).—Mohpani coal field. Lead-ore at Shimanabad, Jabalpur district. Coal east of Chhattisgarh between Bilaspur and Ranchi. Petroleum in Burma. Petroleum locality of Sudkal, near Futtijung, west of Rawalpindi. Argentiferous galena and copper in Manbhum. Assays of iron ores.

Part 4 (out of print).—Geology of Mount Tilla, Punjab. Copper deposits of Dalbhum and Singhbhum: 1.—Copper mines of Singhbhum. 2.—Copper of Dalbhum and Singhbhum. Meteorites.

Vol. IV, 1871.

Part 1 (out of print).—Annual report for 1870. Alleged discovery of coal near Gooty, and of indications of coal in Cuddapah district. Mineral statistics of Kumaon division.

Part 2 (out of print).—Axial group in Western Prome. Geological structure of Southern Konkan. Supposed occurrence of native antimony in the Straits Settlements. Deposit in boilers of steam-engines at Raniganj. Plant-bearing sandstones of Godavari valley, on southern extensions of Kamthi group to neighbourhood of Ellore and Rajmandri, and on possible occurrence of coal in same direction.

Part 3 (out of print).—Borings for coal in Godavari valley near Dumaguden and Bhadrachalam. Narbada coal-basin. Geology of Central Provinces. Plant bearing sandstones of Godavari valley

Part 4 (out of print).—Ammonite fauna of Kutch. Raigur and Hengir (Gangpur) Coal-field. Sandstones in neighbourhood of first barrier on Godavari, and in country between Godavari and Ellore.

Vol. V, 1872.

Part 1 (out of print).—Annual report for 1871. Relations of rocks near Murree (Mari), Punjab. Mineralogical notes on gneiss of South Mirzapur and adjoining country Sandstones in neighbourhood of first barrier on Godavari, and in country between Godavari and Ellore.

Part 2 (out of print).—Coasts of Baluchistan and Persia from Karachi to head of Persian Gulf, and some of Gulf Islands. Parts of Kummummet and Hanamconda districts in Nizam's Dominions Geology of Orissa. New coal-field in south-eastern Hyderabad (Deccan) territory.

Part 3 (out of print)—Maskat and Massandim on east of Arabia. Example of local jointing Axial group of Western Promo Geology of Bombay Presidency

Part 4 (out of print)—Coal in northern region of Satpura basin Evidence afforded by raised oyster banks on coasts of India, in estimating amount of elevation indicated thereby Possible field of coal measures in Godavari district, Madras Presidency Lameta or intra-European formation of Central India Petroleum localities in Pegu Supposed eozoonal limestone of Yellam Bile

Vol VI, 1873

Part 1 Annual report for 1872 Geology of North West Provinces

Part (out of print)—Bisrampur coal field Mineralogical notes on gneiss of south Mirzapur and adjoining country

Part (out of print)—Celt in cretaceous deposits of Narbada valley (Phocene of Falconer) on age of deposits and on associated shells Barakars (coal measures) in Beddadanole field, Godavari district Geology of parts of Upper Punjab Coal in India Salt springs of Pegu

Part 4 (out of print)—Iron deposits of Chanda (Central Provinces) Barren Islands and Narkondam Metalliferous resources of British Burma

Vol VII, 1874

Part 1 (out of print)—Annual report for 1873 Hill ranges between Indus valley in Ladak and Shahr Dula on frontier of Yarkand territory Iron ores of Kumaon Raw materials for iron smelting in Raniganj field Plastic sandstone or so-called Itacolumyte Geological notes on part of Northern Hazaribagh

Part (out of print)—Geological notes on route traversed by Yarkand Embassy from Shahr Dula to Yarkand and Kashgar Jade in Karakas valley Turkistan Notes from Eastern Himalaya Petroleum in Assam Coal in Garo Hills Copper in Narbada valley Potash salt from Lake Indus Geology of neighbourhood of Murree Hill station in Punjab

Part 3 (out of print)—Geological observations made on a visit to Chaderkul, Thian Shan range Former extension of glaciers within Kangra district Building and ornamental stones of India Materials for iron manufacture in Raniganj coal field Manganese ore in Wardha coal field

Part 4 (out of print) Auriferous rocks of Dhambal hills Dharwar district Antiquity of human race in India Coal recently discovered in the country of Tumi Pathans south-east corner of Afghanistan Progress of geological investigation in Godavari district, Madras Presidency Subsidiary materials for artificial fuel

Vol VIII 1875

Part 1 (out of print) Annual report for 1874 The Altum Artush considered from geological point of view Evidence of former glaciation in tropical India during Talchir period Trials of Raniganj fire-bricks

Part 2 (out of print)—Gold fields of south-east Wynaad, Madras Presidency Geological notes on Khasi and hills in Upper Punjab Water-bearing strata of Surat district Geology of Sondwa territories

Part 3 (out of print)—Shahpur coal field, with notice of coal explorations in Narbada regions Coal recently found near Moflong, Khasia Hills

Part 4 (out of print)—Geology of Nepal Raigarh and Hingir coal fields

Vol IX, 1876

Part 1 (out of print)—Annual report for 1875 Geology of Sind

Part 2 (out of print)—Retirement of Dr Oldham Age of some fossil floras of India Cranium of Stegodon Ganesa, with notes on sub-genus and allied forms Sub-Himalayan series in Jamu (Jammoo) Hills

Part 3 (out of print)—Fossil floras in India Geological age of certain groups comprised in Gondwana series of India, and on evidence they afford of distinct zoological and botanical terrestrial regions in ancient epochs Relations of fossiliferous strata at Maleri and Kota, near Sironcha, C P Fossil mammalian faunæ of India and Burma

Part 4 (out of print)—Fossil floras in India Osteology of Merycopotamus dissimilis Addenda and Corrigenda to paper on tertiary mammalia Plesiosaurus in India Geology of Pir Panjal and neighbouring districts

Vol X, 1877

Part 1 (out of print)—Annual report for 1876 Geological notes on Great Indian Desert between Sind and Rajputana Cretaceous genus Omphalia near Nameho lake Tibet about 75 miles north of Lhassa Estheria in Gondwana formation Vertebrata from bed in tertiary and secondary rock New Emydine from the upper tertiaries of Nahan in Punjab Observations on under-ground temperature

RECORDS

OF

THE GEOLOGICAL SURVEY OF INDIA

RECORDS

OF

THE GEOLOGICAL SURVEY OF INDIA

VOLUME LIX.

Published by order of the Government of India.

CALCUTTA GOVERNMENT OF INDIA
CENTRAL PUBLICATION BRANCH
1927

CONTENTS.

PART 1.

PART 2.

CONTENTS.

PART 3.

PART 4.

LIST OF PLATES, VOLUME LIX.

PLATE 1.—Figs. 1 and 2.—(×3). *Nummulites stamineus*, sp. nov. Kalu Kushtak Nala, 5 miles N. W. of Dera Bugti, Bugti Hills, Baluchistan. Holotype, fig. 2 :—2 miles S. W. of Godhathad (Gotathad), Cutch.

Fig. 3.—(×5). *N. stamineus*, sp. nov. Equatorial section : 1 mile S. of Waghapadar (Waggerpudder), Cutch.

Figs. 4 and 5.—(×5). *N. beaumonti*, D'Arch. W. of Dawagai, Dera Ghazi Khan foothills, S. W. Punjab. Fig. 5 :—Equatorial section.

,, 6 and 7.—(×5) *N. laevigatus*, (Brug.). Rohri, Sind. Fig. 6 :—Equatorial section. Fig. 7 : Lateral section.

PLATE 2.—Figs. 1, 2 and 3.—(×3). *Nummulites acutus*, Sow. Figs. 1 and 2 :—2 miles S. W. of Godhathad (Gotathad), Cutch. Fig. 3 :—Sowerby's original type from Lakhpat (Lukput), Cutch.

Fig. 4.—(×5) *N. acutus*, Sow. Lateral section ; same locality as fig. 1.

Figs. 5, 6, 7 and 8.—(×5). *N. scabrus*, Lam. Fig. 5 :—Axial section ; Rohri, Sind. Fig. 6 :—Lateral section : W. of Laki village, Sind. Fig. 7 :—Lateral section ; Rohri, Sind. Fig. 8 : Equatorial section ; Rohri, Sind.

Fig. 9.—(×5). *N. perforatus*, (de Mont.). N. E. of Pabuni Chauki, Las Bela State, Baluchistan.

,, 10.—(×2). *N. obtusus*, Sow. Mardan Nala, Mula River, Kalat State, Baluchistan.

PLATE 3.—Figs. 1 and 2.—(×5). *Nummulites obtusus*, Sow. Lateral sections. Fig. 1 :—Sham plain, Bugti Hills, Baluchistan. Fig. 2 :—Kalu Kushtak Nala, 5 miles N. W. of Dera Bugti, Bugti Hills, Baluchistan.

Fig. 3.—(×2). *N. gizehensis*, (Forks.). Rohri, Sind.

Figs. 4 and 5.—(×5). *N. carteri*, D'Arch. and Haime. Sukkur, Sind. Fig. 4 :—Lateral section. Fig. 5 :—Equatorial section.

,, 6 and 7.—(×5). *N. gizehensis*, (Forks.). Rohri, Sind. Fig. 6 :—Lateral section. Fig. 7 :—Equatorial surface.

PLATE 4.—Fig. 1.—(×2). *N. carteri*, D'Arch. and Haime. Sukkur, Sind.

,, 2.—(×5). *N. maculatus*, sp. nov. Equatorial surface : 1 mile N. E. of Ber Nani, Cutch.

,, 3.—(×2). Do. Holotype. Same locality as fig. 2.

,, 4.—(×5). Do. Lateral section. Same locality.

CORRIGENDA.

Page 118. 3rd para., 4th line, for '*Sowerbyi*' read '*sowerbyi*.'

Page 121. Under (3) Table, for '*Dictyoconoides cooki*, Carter' read '*Dictyoconoides cooki* (Carter).'

Page 122. 2nd para., 1st line, for '(46)' read '(48).'

Page 125. 2nd para., 1st line, for '*Faraminifera*' read '*Foraminifera*.'

Page 127. Insert '(B)' before 'List of Foraminifera and Classification of Nummulites.'

Page 128. In list of species, for '*A: concellata*' read '*A. cançellata*.'

Page 129. 4th and 6th lines, for '(see Nuttall 48)' read '(see Nuttall 47).'

Page 130. 7th line from base, for 'D'Archiac and Harpe' read 'D' Archiac and Haime, Harpe.'

Page 131. 2nd para., 3rd line, for 'Plate I, figure 5' read 'Plate I, figure 4.'

Page 133. 2nd para., 5th and 6th lines, for '*Nummulites vredenburgi*' read '*Nummulites vredenburgi* Prever.'

Page 134. 3rd. para., 1st line, for 'Marti' read 'Martin' and 5th para., 1st line, for '(Bruguière, sp.)' read '(Bruguière).'

Page 135. 4th para, 3rd line, for 'A. and Lister' read 'A. and H., Lister' and 4th line, for 'Brug,' read '(Brug.).'

Page 136. 1st para, 3rd line, insert comma after 'Lamarck.'

Page 138. 4th para., 4th line, insert single brackets before and after 'de Mont.' and 5th line, insert single brackets before and after 'de Mont.' and after 'Dainelli' insert '(15c).'

Page 139. 2nd para., for '(21)' read '(2 l),' and last para., 3rd line for '(21)' read '(2 i).'

Page 140. 2nd para., 5th line, for 'Plate, fig. 6' read 'Plate 3, fig. 6.'

Page 143. 3rd para., 4th line, delete comma after 'D' Archiac.'

Page 152 1st para., 1st line, delete '54'; 2nd para., 1st line, for '(1)' read '(2)' and last line but one, for '( )' read '(p)'.

Page 156. Against item (25), 1st line, delete 'I'; against item (26), 2nd line, for '*Ist*' read '*Ist.*'

Page 157. Item (31), for 'Gümbel' read 'Gümbel.'

Page 163. In explanation of Plate V, 5th line, for 'Fig:—5·3 miles' read 'Fig. 5 :—3 miles.'

Page 237, line 1. For 'Conulites-Dictyoconoides Nuttall' read 'Conulites (=Dictyoconoides, Nuttall).'

Page 249, line 12 from top. For 'first at' read 'at first.'

Plate 1. Fig. '5×6' should read '5×5'; also at foot of each plate for 'Nuttal' read 'Nuttall.'

Plate 19. Omit figures 11, 11a, 11b and 11e.

RECORDS

OF

THE GEOLOGICAL SURVEY OF INDIA.

Part 4] 1926 [December.

THE OCCURRENCE OF LOW-PHOSPHORUS COKING COAL IN THE GIRIDIH COAL-FIELD.

BY CYRIL S. FOX, D.SC., M.I.MIN.E., F.G.S., *Assistant Superintendent, Geological Survey of India.* (With Plate 27.)

1.—Introduction.

IT has been the prevailing opinion for more than half a century that the coking coals from the Gondwana fields are characterised by a relatively high phosphorus content. This is said to be particularly true of the coal from seams in the Damuda valley and Giridih Coal-fields. It has been claimed that but for this feature India might have been a great producer of pig iron of Bessemer quality and an important manufacturer of ferro-manganese of the highest grade. It is true that pig iron with less than 0·06 per cent. of phosphorus can only be made from specially chosen raw materials. It is also true that even with the best available domestic ores and coke it has so far been impossible in India to produce either Bessemer pig or ferro-manganese equal in quality to the best English material. In both these cases the high phosphorus content of the raw materials has been directly responsible for the lack of success. The percentages of phosphorus in the iron ores of Bonai, Mayurbhanj and Singhbhum are well known to the chemists of Jamshedpur, Kulti and Hirapur. These metallurgists are, presumably, equally familiar with or not entirely ignorant of the amounts of phosphorus in the various Indian manganese ores.

The statement has been made ("The Metallurgy of Iron," 1909, page 199, by T. Turner) that "If it is desired, with an ore containing 50 per cent. metallic iron, to produce pig iron containing under 0·06 per cent. of phosphorus, the ore must not contain over 0·02 of phosphorus unless the coke contains less than this small proportion. Hence some cokes are unsuitable for the production of iron of Bessemer quality." It is not my purpose to discuss any other subject than that of the phosphorus in Indian coking coals and the coking coals of Giridih in particular. This factor of 0·02 per cent. of phosphorus as a maximum percentage in metallurgical coke will be adopted in this paper in dealing with Indian cokes for the above mentioned special smelting purposes. It is also beyond the scope of this paper to make any suggestions with regard to similar investigations in the case of non-coking coals, iron ores, manganese ore, and the fluxes limestone and dolomite. A perusal of the available data shows that a great deal of testing has been done and numerous analyses have been made, but that only in exceedingly rare instances have special maps or plans been kept indicating the exact position from which the various samples were obtained. Without such a record probably more than half the value of an analysis is lost.

2.--Various Coking Coals.

The best quality metallurgical coke from coking coal of Indian origin has long been reputed to come from the Giridih field. Its phosphorus content was said to average 0·05 per cent. if the coke were made from selected lump coal of the lower Karharbari seam. At present only 'slack' is being used for coke making. This material is not only from 2 to 3 per cent. higher in ash than the good lump coal but also carries a larger proportion of phosphorus, so that the present-day Giridih coke frequently contains more than 0·08 per cent. of phosphorus. Among other good metallurgical cokes may be mentioned that of Bararee (machine-cut slack, No. 15 seam, an analysis of which is given below). Another Jharia coal, that from Jamadoba (mixture of Nos. 17 and 18 seams) which, as seen in the analysis below, carries a very high percentage of phosphorus, is also of good coking quality. Analyses of coking coals from the Raniganj field are also shown, including one from the Barakar measures (Ramnagar seam) and others from the Raniganj series (Dishergarh seam, Saltore). It may be here mentioned that the Chanch-Begonia-Rampur seams and the

thick Laikdih-Borea seams (Barakar stage) are also reputed to be of fair coking quality, but the phosphorus content of these coals is not at present fully known.

The coal of the lower sections of the thick Bokaro field seams has in several places been proved to be of good quality and to possess strong coking properties. As regards the Sirka-Argada upper seam of the Karanpura field, I have seen excellent samples of coke, made at Loyabad, from a mixture, 50–50, of this coal with Saltore (Dishergarh) slack. Beyond the limits of the Damuda valley the coals of Gondwana age appear, in general, to be either non-coking or to coke weakly. In the case of the Kanhan coal in the Satpura field and the Rajgumar seam in the Korba field the coal has been found to possess fairly good coking properties, but the coke is not strong enough for furnace loads. Judging by the analysis of the Ib River coal from Rampur Indian coals outside the Damuda valley vicinity are freer from phosphorus than the seams of Giridih, Raniganj, Jharia, etc. The sulphur content of the excellent coking coals of Assam makes them unfit for metallurgical work.

With regard to the analyses shown in tables I and II attention is drawn to the fact that in some cases the reckoning is given on a moisture-free basis so that I have re-calculated the percentages to include the moisture for correct comparison. With reference to the detailed composition of the ash the percentages are in terms of the coal. This makes it easier to see the true amount of the impurity, etc., in the coal. The data for New South Wales are re-calculated from data in the *Department of Mines, Mineral Resources Bulletin*, No. 23, 1916, a report by L. F. Harper and J. C. H. Mingaye. The analysis of the remarkable anthracite coal from Natal is quoted from page 39 in the brochure of the *Imperial Mineral Resources Bureau* on "Coal, Coke, and by-Products," (1913-19), Part II, 1921.

Table I.—*Analyses of Indian Coals.*

	1	2	3	4	5	6	7	8	9	10	
	Giridih.	Jharia 12.	Jharia 14.	Jharia 15.	Jharia 17 and 18.	Raniganj, Ramnagar	Raniganj, Bejdih.	Raniganj, Saltore.	Raniganj, Ghusick.	Karanpura Sirka Lower	Argada Upper.
Fixed carbon	58 33	66 04	64 4	64 44	57 3	55 20	46 00	53 53	49 40	52 50	51 11
Volatile matter	25·10	19 34	18 7	22 50	27 4	27 40	32 50	33 83	33 60	30 47	30 76
Moisture	1 50	0 46	3 3	1 50	1 3	2 0	2 70	2 25	6·40	1 36	1 91
Sulphur	0 39	0 36		0 24 fixed 0 52 volatile		?	?	0 39	?	0 91	0 65
Ash	14 68	13 80	13 09	11 00	14 00	15 40	9 80	10 00	10 60	14 76	15 35
Details of Ash in percentages of coal.											
Silica	9 69	8 56	6 93	4 31	7 07	8 285	4 37	5 05	5 06	8 66	8 56
Alumina	3 52	3 74	4 08	3 94	4 03	3 95	2 81	2 40	2 88	4·62	5·37
Ferric oxide	0 61	0 96	92	0 56	1 16	1 76	0 88	1 00	1 09	1·26	1 04
Manganese oxide	0 135	.	.		0 022	0 057	..	..	..	..	..
Lime	0 19	0 08	0 54	0 81	0 70	0 508	0 91	1 00	·68	0 15	0 31
Magnesia	0 13	0 14	0 10	0 37	0 14	0 215	0 26	0 25	trace	0 02	0 06
Phosphorus pentoxide	0 179	0 022	0 26	0 185	0 508	0 252	0 177	0 314	·487	0 21	0 083
Other constituents, sulphur, etc.	0 210	0 02	1 36	.	.	0 367	0 37	..	..	..	0 79
Phosphorus in coal	0 075	0 01	0 12	0 077	0 213	0 105	·080	0 13	0 199	0 09	0 035

1. Giridih, typical analysis, coal from Serampore Colliery. (A. Dawes Robinson).
2. No. 12 seam, Loyabad, 5 Pit (E. Spencer).
3. No. 14 seam, Ekhra Khas (Alipur Test House through C. S. Whitworth).
4. No. 15 seam Bararee. Machine-cut slack lower part of seam (B. Wilson Haigh).
5. Nos. 17 and 18 seam, Jamadoba mixed. Upper 7′ 6″ and lower 5′ of 18 with 7′ of 17 seam (F. G. Percival).
6. Ramnagar (Barakar Stage) (A. Dawes Robinson).
7. Bejdih, Dishergarh seam, 14 and 15 (Alipur Test House through C. S. Whitworth).
8. Saltore, Dishergarh seam, 16 to 18 (E. Spencer).
9. Damra, Ghusick, 10 feet (Alipur Test House through C. S. Whitworth).
10. Sirka, Argada seam. Makes excellent coke when mixed 50—50 with Saltore slack (E. Spencer).

N.B.—These analyses have been re-calculated to include moisture. The sulphur is shown separately. A third of the total sulphur has been subtracted from the fixed carbon and the remainder from the volatile matter to obtain uniformity in the analyses.

TABLE II.—*Analyses of Foreign Coals (coking)*

	1	2	3	4	5	6
Fixed carbon	61·31	53·40	49·74	79·53	60·01	60·92
Volatile matter	24·43	35·27	41·45	9·18	33·49	32·60
Moisture	dry basis	dry basis	dry basis	dry basis	1·13	dry basis
Sulphur	?	?	?	1·53	1·92	1·08
Ash details.						
Silica	6·841	5·889	2·944	6·097	1·083	3·063
Alumina	4·381	2·552	2·127	3·721	0·727	1·875
Ferric oxide	?	1·180	0·729	0·622	0·787	0·275
Manganese oxide	0·001	0·018	0·001	?	0·0189	?
Lime	0·701	0·259	0·326	0·355	0·5589	0·135
Magnesia	0·190	0·050	0·131	0·152	0·0034	0·0399
Phosphorus pentoxide	0·093	0·072	0·069	0·049	0·00379	0·0518
Sulphur trioxide	0·236	0·026	0·017	0·232	0·2415	?
Alkalies, etc.	?	..	..	0·090	with P_2O_5	?
TOTAL ASH	13·77	10·29	6·71	11·28	3·45	5·40
Phosphorus in coal	0·039	0·030	0·028	0·020	0·0018*	0·0217

1. New South Wales, Bulli seam, Bulli Coke Works. Also used in Broken Hill Proprietary Steel Works, Waratah. (H. P. White).
2. New South Wales, Borehole seam, Wallsend Purified Coke and Coal Co. (H. P. White).
3. New South Wales, Greta seam, Australian Gaslight Co. (H. P. White).
4. South Africa Natal Vryheid Colliery near Mount Ngwibi. Coal used for coking by the Natal Ammonium Ltd. N=2·212 per cent.
5. English Lancashire, 4-foot Wigan. Ash and coal analyses of different samples. *Phosphoric acid included with the alkalies.
6. United States of America, Connellsville. Ash analyses of sample with 95 per cent. ash reduced to terms of 5·40 per cent. for comparison with proximate analysis.

The Research Department of Messrs. Bird & Co., through Dr. E. Spencer, has very kindly given me the following particulars, regarding stray analyses by Valentine, of the phosphorus content of some cokes made from various seams in the Jharia coal-field :—

No.	Seam.	Ash.	Phosphorus.
13A	Jharia (Standard) hard coke . . .	13·0	0·03
14	Ditto	15·7	0·05
15	Ditto	17·4	0·12
12	Loyabad (Pit 5)*.	24·0	0·025
13	Ditto	17·0	0·097
14	Ditto	15·6	0·058
13	Loyabad (Pit 6)*.	17·8	0·093
14	Ditto	20·0	0·088
9	Govindpur soft coke	27·0	0·027
10	Ditto	26·0	0·055
..	Bottom seam (Choranpore?) . . .	21·0	0·04
16	Standard hard coke	30·84	0·59
15	Loyabad (No. 3 incline top section) . .	17·0	0·15
15	Ditto (bottom section)	20·1	0·26
11	Jharia Khas hard coke.	24·6	0·22
12	Ditto	19·0	0·24
1	Tehulmoni hard coke	20·0	0·17
14	Ditto	21·0	0·23
13	Sendra soft coke	22·0	0·19
14	Ditto	19·5	0·14
15	Ditto	21·8	0·23

N.B.—These figures are for coke and not coal, but as all the phosphorus will be found in the coke it is only necessary to know the volatile matter in the corresponding coal to arrive at the phosphorus figure for the coal.

* Compare with No. 2 analysis in Table I.

It may here be mentioned that the average ash, sulphur and phosphorus percentages in the coke used by the Tata Iron and Steel Company may be taken respectively as 21 to 22, 0·5 and 0·16 respectively.

The analysis of the Ib River (Rampur Colliery) coal is shown below together with the rather exceptional analysis* of a low-phosphorus Jharia coal (No. 14A seam, Standard colliery):—

	Ib River Coal.	No. 14A Seam Jharia.
Fixed carbon	51·13	62·93
Volatile matter	30·01	27·72
Moisture	2·50	1·09
Sulphur	0·36	?
Ash	16·00	8·26
Details of ash in percentages of the coal:—		
Silica	7·76	4·89
Alumina	5·61	2·65
Ferric oxide	1·23	0·31
Manganese oxide	0·305	..
Lime	0·24	0·127
Magnesia	0·128	0·101
Phosphoric pentoxide	0·083	0·019
Other constituents	0·79	..
Phosphorus in the coal	0·035	0·009

Analysis of Ib River coal supplied by F. G. Percival.
Analysis of 14A seam Standard Colliery supplied by E. Spencer.

From the analyses given above it is seen that very few Indian coals would give a coke within the limit 0·02 per cent. phosphorus previously accepted as a maximum. Dr. E. Spencer of Bird & Co., has published one analysis of coal from No. 14-A, seam (Standard colliery, Jharia) which shows a phosphorus percentage in the coal as low as 0·009 and says that No. 14 seam in the same area also shows a low phosphorus content in some analyses. None of the Australian coals, not even that used by the smelters at Waratah, will give a fuel suitable for the production of pig iron of Bessemer quality. Certain South African coals (Dumbi with 0·01 and Natal (?) 0·008) give a phosphorus percentage which is satisfactory, but I have not been able to obtain the necessary details of their composition.

* See also analysis No. 2 in Table I.

The exceptional Natal (Vryheid) coal quoted by me is used for gas making, largely for the recovery of ammonium sulphate owing to its richness in nitrogen. Among British coals the coke made from Newcastle coal contains as little as 0·012 per cent. of phosphorus. In Yorkshire the phosphorus content of the coke varies from 0·009 (Monckton) to 0·022 (Barrow) and 0·032 (Robin Hood) per cent. Derbyshire cokes have percentages of phosphorus from 0·006 (Hucknall) and 0·011 (Bentnick) to 0·036 (Bolsover). South Wales coals give cokes with from 0·022 to 0·05 per cent.

On the Continent, Ruhr coke averages 0·022 to 0·035 per cent. of phosphorus, but there is a noticeable increase in the phosphorus content from "fat" coals (Gelsenkirchen, 0·0145 P.) to "lean" coals (Sprocknövel, 0·0248 P.). Normal French cokes contain from 0·022 to 0·04 per cent. of phosphorus. Of 56 analyses of Westphalian coke 4 samples showed less than 0·01 per cent. of phosphorus, 41 contained between 0·01 to 0·02, 10 varied between 0·02 and 0·03 and only one had over 0·03 per cent. of phosphorus.

In America, "Pennsylvania coke shows on an average 0·01 per cent. of phosphorus, that from Mingo mountain (Tenn) 0·008 per cent., and Puineville coke only 0·007 per cent. of phosphorus. A larger quantity is found in coke from West Virginia, which has 0·027 per cent., while that from Illinois contains 0·033 per cent. In coke from upper Freeport coal (Alleghany River), McCreath found phosphorus to the extent of 0·1085 per cent., the coal itself containing 0·0681 per cent." ("Chemistry of Coke," 1904, page 119. W. Carrick Anderson.)

It is not to be forgotten that many foreign coals are amenable to improvement in quality by washing. This treatment at present appears to be unsatisfactory with most Indian coals. In this connection may be mentioned the case of the coal used in the Mount Lyall Coke Works at Port Kembla in New South Wales, where an unwashed coal (A) gave washed coal (B) with a coke (C) having the following composition :—

	(A)	(B)	(C)
Moisture	0·77	0·72	0·73
Volatile matter	22·30	23·56	1·14
Fixed carbon	60·81	63·62	81·87
Ash	16·12	12·10	15·95
Sulphur	0·262	0·269	0·31
Specific gravity	1·406	1·385	1·812

The ash of this coke (C) contained :—

Moisture at 100°C	0·07 per cent.
Silica	54·11 ,,
Alumina	33·46 ,,
Ferric oxide	4·75 ,,
Ferrous oxide	0·23 ,,
Manganese oxide	trace
Lime	1·92 ,,
Magnesia	0·53 ,,
Barium oxide	0·30 ,,
Strontium oxide	present
Soda	0·61 ,,
Potash	1·74 ,,
Lithia	present
Titanium oxide	1·45 ,,
Phosphorus pentoxide	0·50 ,,
Vanadic oxide	0·01 ,,
Sulphur trioxide	0·55 ,,
Phosphorus in coke	0·033

Analyst H. P. White : *See* Paper by Harper and Mingaye (*op cit*).

It is unfortunate that no detailed analysis of the ash of the unwashed coal is available as the percentage of phosphorus in the two coals,—unwashed (A) and washed (B)—might have been compared.

3. Giridih ; Karharbari Lower Seam.

While preparing my report on "The Raw Materials for the Iron and Steel Industry of India" for the Tariff Board in 1923[1], I noticed marked variations in the percentages of phosphorus in different analyses of Indian coking coals. From the available data it was impossible to discover if those variations in the phosphorus content were due to a variableness in the original constituents of the plant material or to the impregnation of the coal by secondary calcium phosphate. I believed that a large part of the phosphorus, and therefore the variable part, had been introduced into the coal subsequent to its formation. In this opinion I found myself in agreement with the views of the metallurgical chemists at the three smelting centres in India. Dr. E. Spencer of Messrs. Bird & Co.'s Research Department had meanwhile produced evidence in support of this opinion and handed me a copy of his published work. With this I shall deal later. I had, previous to obtaining any knowledge

[1] See *Trans. Min. Geol. Inst. Ind.*, Vol. XX, Pt. 2, 1925.

of his work in this connection, decided to investigate the matter, and chose as the most suitable place the East Indian Railway collieries at Giridih. With the very kind assistance of Mr. H. Lancaster, Superintendent of these collieries, carefully collected samples were obtained from Serampore colliery and Karharbari colliery. The places were selected with regard to the location of faults, dolerite and mica-peridotite dykes and certain areas free of these disturbances (*See* Plate 27). Mr. A. Dawes Robinson of the Bengal Iron Co., Ltd., at Kulti very kindly undertook to have these samples analysed. His results are shown in the following Tables III, IV, V, VI, VII and VIII.

TABLE NO. III.—*Analyses of Samples A (see Map plate 27), Deep Pit, Serampore Colliery, Giridih.*

	Roof Coal, 4 feet	Top Middle Coal, 4 feet	Middle Coal, 9 feet.	Lower Middle Coal, 4 feet.	Floor Coal, 3 feet.
Fixed carbon	61 06	58 33	61 61	55 48	44 66
Volatile matter	24 40	25 10	24 40	23·78	15 55
Moisture	1 40	1 50	1 20	1 60	1 80
Sulphur	0 40	0 39	0 39	0 34	0 39
Ash	12 74	14 68	12 40	18·80	37·60
Details of ash impurities given as percentages in the coal.					
Silica	9 019	9 680	6 572	10 908	..
Alumina	2 567	3 523	3 744	5 720	..
Ferric oxide	0 395	0 616	1 240	0 123	..
Manganese oxide	0 132	0 135	0 135	0·193	..
Lime	0 255	0 188	0 198	0·206	..
Magnesia	0 108	0 132	0 098	0·165	..
Sulphur trioxide	0 018	0 023	0 019	0 033	..
Phosphorus pentoxide	0 112	0 179	0 270	0 114	0 127
Alkalies	0 137	0 187	0 121	0 225	..
Phosphorus in coal	0 049	0 078	0 119	0 048	0 056

N.B.—The sulphur trioxide in the ash re-calculated to the coal is misleading.

All the above coal is coking coal.

Average of the full thickness of the seam, 24 feet (24 samples)	Per cent.
Ash	17·05
Phosphorus in coal	0·0987

TABLE No. IV.—*Analyses of Samples B (see Map plate 27), North Central No. 2 Pit, Serampore Colliery, Giridih.*

	Upper Coal	Upper Middle Coal			Middle Coal.			Lower Middle Coal, 5 feet.	Floor Coal, 3 feet.
	Roof Coal, 4 feet.	1 foot.	2 feet.	1 foot.	1 foot.	1 foot.	1 foot.		
Fixed carbon .	57·31	53·43	58·03	54·75	63·43	57·17	61·87	53·35	43·35
Volatile matter	26·0	23 8	25·10	20 30	26·00	23 20	23·10	24·50	17·5
Moisture .	1·40	1 40	1·45	1·60	1·40	1·40	1·30	1·40	1·20
Sulphur . .	0·39	0·37	0·37	0·35	0 37	0 33	0·33	0·35	0·35
Ash . .	14·90	21·00	14·15	23·00	8·80	17·90	13·40	20·40	37·60
Details of ash impurities given as percentages in the coal.									
Silica . .	10·281	..	9·706	..	5·033	12·53	7·396	..	..
Alumina . .	2·443	..	2 945	..	2·413	3·615	4·054	..	..
Ferric oxide .	1·370	..	0·727	..	0 754	0·823	0·956	..	..
Manganese oxide	0·147	..	0·128	..	0 092	0 194	0·132	..	..
Lime . .	0 283	..	0·240	..	0 202	0·322	0·321	..	..
Magnesia .	0·156	..	0 152	..	0·104	0 182	0·163	..	..
Phosphoric acid	0 034	0 037	0 033	0 033	0 013	0 071	0·175	0·203	0 065
Sulphur trioxide	0·026	..	0·017	..	0 011	0·025	0 020	..	..
Alkalies, etc. .	0·156	..	0·179	..	0 083	0·0134	0·178	..	..
Phosphorus in coal.	0·015	0·017	0 014	0·015	0 045	0 032	0 076	0·089	0·03

N.B.—The sulphur trioxide in the ash re-calculated to the coal is misleading.

All this coal is coking coal.

	Per cent.
Average of the full thickness of the seam, 19 feet, (19 samples):—	
Ash	19·01
Phosphorus in coal	0·045

TABLE NO. V.—*Analyses of Samples C (see Map plate 27), Jubilee Pit, Karharbari Colliery, Giridih.*

	Top of seam	Middle of seam	Bottom of seam.
Fixed carbon	64·34	65·94	69·53
Volatile matter	26·50	25·50	23 50
Moisture	1·40	1·20	1 60
Sulphur	0 36	0 36	0·37
Ash	7 40	7·00	5 00
Details of impurities in ash as percentages in the coal.			
Silica	5·032	3·92	2·94
Alumina	1·740	1·84	1·26
Ferric oxide	0·232	0 84	0·520
Manganese oxide	0 068	0 071	0·051
Lime	0 133	0 084	0·060
Magnesia	0 077	0 110	0 082
Phosphorus pentoxide	0 013	0 015	0·0055
Sulphur trioxide	0 013	0 011	0 009
Alkalies	0·078	0·099	0·072
Phosphorus in coal	0·0059	0·007	0 0025

N.B.—The sulphur trioxide of ash shown as percentages of coal is misleading.

All coking coals.
Average of samples for a thickness of 14 feet 6 inches of the seam.

	Per cent.
Ash	6·47
Phosphorus	0·0052

TABLE NO. VI.—*Analyses of Samples D (see Map plate 27), Bitagarha Pit, Karharbari Colliery, Giridih.*

——	Top of seam.	Middle of seam.	Bottom of seam.
Fixed carbon	63·16	65 15	50·95
Volatile matter	23·00	28 10	19 80
Moisture	1·40	1·50	1·40
Sulphur	0·44	0 45	0 45
Ash	12 00	4 80	27·80
Details of impurities in ash as percentages in the coal.			
Silica	7·488	2·784	14 905
Alumina	3·432	1·334	8·463
Ferric oxide	0·480	0 475	2·650
Manganese oxide	0 111	0·044	0 202
Lime	0 072	0 067	0·328
Magnesia	0·129	0·037	0·353
Phosphorus pentoxide . . .	0·013	0 015	0 013
Sulphur trioxide	0·019	0 008	0·049
Alkalies, etc.	0·254	0·075	0·421
Phosphorus in coal . . .	0·0057	0·007	0·0063

N.B.—The sulphur trioxide of ash re calculated to the coal is misleading.

	Per cent.
Average of samples for the full thickness of the seam, 18 feet:—	
Ash	14·73
Phosphorus	0·0063

TABLE NO. VII.—*Analyses of Samples E, Ramnadih Pit, Karharbari Colliery, Giridih.*

	Top of seam.	Middle of seam.	Bottom of seam.
Fixed carbon	66 61	60 72	64 19
Volatile matter	21 10	24 80	25 20
Moisture	1 80	1 40	1 40
Sulphur	0 49	0 48	0 41
Ash	10 00	12·60	8·80
Details of impurities in ash as percentages in the coal.			
Silica	7 08	8 290	4 963
Alumina	1 940	3 094	2 544
Ferric oxide	0 60	0 647	0·728
Manganese oxide	0 093	0 117	0 130
Lime	0 140	0 126	0·140
Magnesia	0 108	0·181	0 139
Phosphorus pentoxide	0 022	0·027	0·019
Sulphur trioxide	0 008	0 020	0 012
Alkalies, etc	0 109	0 094	0 121
Phosphorus in coal	0 01	0 012	0 009

N.B.—The sulphur trioxide of ash re-calculated for the coal is misleading.

	Per cent.
Average of samples for the full thickness of the seam, 10 feet :—	
Ash	10·47
Phosphorus	0·0103

TABLE VIII.—*Averages of Samples.*

Samples.	Ash.	Phosphorus in Ash.	Phosphorus in Coal.	Depth to top of seam.	Thickness of seam.
Deep Pit	17·05	0·579	0·0987	840 ft. (?)	24 ft.
North Central No. 2 . .	19·01	0·238	0·045	340 ft. (?)	19 ft.
Jubilee	6·47	0·077	0·0052	772 ft.	14 ft. 6 in.*
Bitagarha . . .	14·73	0·042	0·0063	222 ft.	18 ft.
Ramanadih . . .	10·47	0·100	0·0103	150 ft.	10 ft.

* In the Jubilee Pit there is a band of stone situated as follows :—

5′ Coal.
3′ Stone.
9′ 6″ Coal.

I have re-calculated the ash components in terms of their percentages in the coal. These analyses clearly show the marked variations in the phosphorus percentage not only in the coal at the five places sampled, but in the vertical section of the coal at each place. It is most interesting to discover that the phosphorus percentage is highest in the middle part of the seam, which, consisting of a larger proportion of bright coal laminæ than either the top or bottom of the seam, is also generally lower in its ash content. This is very marked in the case of the sample (C) from the Jubilee Pit (Table V) where the middle coal underlies a 3-foot band of stone. In this case the floor coal appears to be absent or to have been missed.

In reply to an enquiry as regards the entry of percolating water from the coal into the workings Mr. Fullwood, the Officiating Superintendent, states that in the case of the Karharbari Colliery "what does come through is from the middle to the bottom of the lower section of the seam." With regard to the Serampore Colliery he states:—"In other places where galleries are being driven to develop new areas I find that water only percolates through the sections where the coal is bright and soft and not through the dull and hard sections, as the latter are more compact and consequently impervious." The importance of Mr. Fullwood's communication will be shown in the next section of this paper.

Details of the samples taken from the Deep Pit, Table III, and North Central Pit No. 2, Table IV, are as follows:—

Section of Coal at A, Deep Pit.

	Feet.	
Roof.		—
Roof Coal.	1	Laminated, hard, brightish-dull coal (*durain* with some laminæ of *clarain*); a little pyrite visible in cleavage planes.
	2	Similar to the 1st foot but with a granular texture.
	3	Similar to 1st and 2nd; pyrite not evident; *fusain* well seen in partings.
	4	Laminated dull and brightish coal; pyrite visible; specimen like top 3 feet.
Top Middle Coal.	5	Laminated dull and bright coal; sample fragments smaller in sizes but the material brighter and better than the roof coal.
	6	Brightish, dull, laminated coal, very like the top 4 feet; sample drier than that of the coal above it.
	7	Very like the 5th foot; dull and bright laminæ well pronounced; rather friable.
	8	Largely of dull, hard coal, not unlike the roof coal; sample in small fragments due to the hardness of the coal; laminated structure clearly seen.
Lower Middle Coal.	9	Laminated, dull and bright coal, with pronounced banding; pyrite evident in cleavage planes; sample rather damp; development of white coating in cracks.
	10	Laminated dull and bright coal, its general look brightish; fragments hard but the sample not as damp as the 9th foot; no pyrite or white matter evident.
	11	Pronounced banding of dull and bright laminæ; general appearance dull; material fairly hard.
	12	Brightish, dull laminated coal; very like roof coal; sample fairly dry; material moderately hard and metallic looking.
	13	Very like roof coal; fine granular rather than laminated structure; evidence of iron stains on cleat surfaces; sample dry.
	14	Almost identical with the 13th foot.
	15	Laminated, dull to bright (metallic) coal, with granular texture evident; cleat rhombohedral; material clean, dry and hard.
	16	Like the 15th foot but with more *clarain*; material consequently more friable; fairly dry; white powdery material in joints; cleat faces slightly stained.
	17	Similar to the 16th foot; cleat vertical; general appearance dull metallic; somewhat friable but fairly dry.

P.T.O.

Section of coal at A, Deep Pit—contd.

	Feet.	
Bottom Coal.	18	Dull to bright, fairly hard, dry coal; structure laminated to granular; slight development of white powder in cleat; flakes of *usain* evident on lamination planes.
	19	Similar to the 18th foot, bright laminæ better seen; coal slightly stained on cleat surfaces; fairly hard and dry.
	20	Dull, metallic, laminated coal; some portions like shale; hard, fairly dry, but the *clarain* laminæ very thin.
	21	Similar to the 20th foot but more uniformly dull, metallic; brittle and moist.
Floor Coal.	22	Dull, shale-like coal; hard and dry.
	23	Dull, shale-like coal with some thin laminæ of *clarain*; dry to somewhat moist.
	24	Dull, shale-like coal, better than the 22nd foot but worse than the 23rd; hard and dry to moist.
Floor.		

Section of coal at B, North Central No. 2 Pit.

Roof.		
Roof Coal.	Feet. 1	Dull, finely laminated, metallic looking coal; hard, somewhat brittle and damp.
	2	Similar to the top, perhaps a little less dull in appearance; less brittle and slightly damper.
	3	Similar to the 1st and 2nd feet but brighter; brittle, dry and hard.
	4	Finely laminated, dull to bright coal; fairly hard and dry.
Upper Coal.	5	Laminated dull to bright coal; rather metallic looking; fairly dry to damp.
	6	Well defined laminæ of bright and dull bands in the coal; material friable, hard, and moderately dry.
	7	Bright to dull coal; rather metallic looking; streaks of *fusain* between pronounced laminæ of dull and bright coal; bright coal decidedly friable.

P.T.O.

Section of coal at B, North Central No. 2 Pit—contd.

	Feet.	
Middle Coal.	8	Dull, laminated, shale-like coal; resembles floor coal and must be clearly defined in the mine; probably corresponds with stone band of Jubilee Pit.
	9	Bright to dull coal; dry but friable, due to *clarain* laminæ.
	10	Pronounced lamination—dull and bright laminæ; *clarain* well seen.
	11	Laminated dull to bright coal—dull bands ½ inch deep; moist; material fairly hard.
Bottom Coal.	12	General appearance bright to dull, metallic-looking coal; hard, brittle and fairly dry.
	13	Laminated, bright to dull coal; hard and fairly dry.
	14	Hard, fairly dry, dull to brightish (metallic) coal.
	15	Laminated, dull, metallic coal; hard, fairly dry, with granular texture seen.
	16	Laminated, bright and dull coal; granular texture evident; fairly hard and dry.
Floor Coal.	17	Dull-metallic coal—practically carbonaceous shale; dry to moist; hard.
	18	Finely laminated shaly coal; hard and dry.
	19	Finely laminated, dull metallic (shaly) coal; dry and hard.
Floor.		

The coal from the Lower Karharbari seam cannot by any manner of means be described as bright in any section, and the details given above also apply generally to the sections from which samples C, D, and E were collected. It may be said in summary that the coal of this seam throughout the limits of Serampore and Karharbari collieries is usually dull coloured and tolerably homogeneous in structure, the layers of very bright jetty coal being few and ill marked. These *clarain* laminæ are more frequent in the middle sections of the seam as a rule. As seen from the sections the thickness of the seam varies, but there is a general good quality in its composition.

The analyses shown above bring out many points of considerable interest, the most attractive, from an economic point of view

being the low phosphorus content of the seam in the workings of the Karharbari colliery. It is evident, from the three positions sampled, that an excellent fuel is available in this area. If further tests prove that this low phosphorous percentage of the coal is uniform throughout the western side of the East Indian Railway's property at Giridih, as appears to be the case, then the reserves of low phosphorus coal in this area are of some value. These reserves have been estimated in the next section.

4.—Reserves of High-grade Coking Coal in India.

According to W. Carrick Anderson ("Chemistry of Coke," 1904 pp. 157—158): "The following may be regarded as the conditions that ought to be fulfilled by a coke which is to be employed in the smelting of iron, and which may be said to hold for Westphalia, Belgium, France and England :—

(1) 1 per cent. sulphur,
(2) ·018 per cent. phosphorus,
(3) 4 per cent. water,
(4) 9 per cent. ash,
(5) 6 per cent. dust on delivery,
} As maxima.
(6) 40—50 per cent. pore space (in foundry coke 25—40 per cent.).
(7) The coke must possess a hardness of 80 kilos. per sq. cm.
(8) The weight of 1 cc. of the coke (dried at 100° C.) should be 800 to 900 mgrms."

On a basis such as the above the only Indian coking coal of this grade occurs in the Karharbari lower seam (and there only in strictly localized areas and sections of the seam) of the State-owned collieries at Giridih. However, in view of the actual utilization of the coke at present being made from coal in other parts of the Giridih field, and from various seams in the Jharia and Raniganj coal-fields, and the certainty that similar coke can be made by mixing the above coals with coal from the Bokaro and Karanpura fields, it is evident that the European standard quoted above is not strictly applicable, except for very special purposes, for metallurgical coke in India. The allowance for ash in Indian coke is often over 20 per cent.

The subject of reserves of coking coal, as available in India, has, so far as accessible data go, been fully discussed recently (*Trans., Min. Geol. Inst. India*, Vol. XX, Pts. 2 and 4, 1926). In these discussions no specification of a metallurgical coke was brought forward, except perhaps the opinion of one member stipulating that the ash should not exceed 20 per cent.; this amount was shown to be less than that in the coke actually employed at Jamshedpur. It seems unnecessary that any standard should be adopted; this is a matter for the ironmasters to fix or disclose from their experience when buying coking coal or coke.

There is one constituent, phosphorus, the presence of which, above a certain small percentage, renders the coke unfit for use in the preparation of pig iron of Bessemer quality or for the preparation of high-grade manganese alloys. The limit adopted as the phosphorus-content of coke for these purposes appears to average about 0·02 per cent. and this amount has evidently been accepted by Indian smelters, and is recognised in this paper. Consquently, from the analyses of coals shown in Tables I to VIII there is no low-phosphorus coking coal in India other than that now shown to occur in the Giridih coalfields. It is quite likely that a similar method of research [*i.e.* (*a*) the careful taking of samples, foot by foot, from several places in the same seam worked by a single colliery; (*b*) the positions from which samples are taken to be recorded on a map specially kept for this purpose: and (*c*) detailed analyses of the coal and ash of these samples carefully made] may also lead to the discovery of other areas in other fields containing low-phosphorus coking coal. These investigations must be left to the enterprise of the companies either engaged in working the coal or in co-operation with the consumers of the special low-phosphorus coke.

Reserves of Low-Phosphorus (0·02 per cent. phosphorus) Coking Coal in Karharbari Colliery.

My examination of the Giridih field, restricted to the collieries worked by Government, lead me to make the following tentative estimate of the total available reserves of low-phosphorus coking coal of the quality (0·02 per cent. P) stipulated by ironmasters

for employment in the production of Bessemer pig and ferro-manganese.

The coal-bearing area in Karharbari colliery is roughly 1,200 acres.

With 140 tons per inch per acre, and an average thickness of 15 feet, the total tonnage will be 30,240,000 tons.

Assuming 1/3 has already been worked the remainder is 20,160,000 tons.

Allowing 1/3 of this to be lost in working, the available coal in the colliery is 13,440,000 tons.

Assuming that about 1/3 of this is unsuitable by being too high in its phosphorus content, the reserves are 8,960,000 † tons.

With a daily output of 1,200 tons or an annual production of 448,000 tons the supplies should last 20 years.

From these calculations, which are probably open to slight modification, both as regards the extent of the unworked coal and the average thickness of the seam, it is clear that these reserves of low-phosphorus coking coal are small and that this fuel should be recognised as a valuable State asset. Continued use of this coal for locomotive and foundry purposes would seem, in a technical sense, to be a squandering of a mineral asset for a purpose other than that for which this class of coal is alone suitable. It is not to be forgotten that mineral assets of this nature when once worked are in a sense lost, and such reserves are irreplaceable.

The high thermal value of the Giridih fuel is fully known. The whole of the lump coal produced is sent away for use as steam coal on the State Railways. All the slack or small coal is converted into coke, chiefly for foundry purposes. Very little, if any, of the local fuel is used at Giridih for steam-raising (power) purposes. It has been found more economical to fetch slack coal from Bokaro for the colliery consumption at Giridih. These domestic economies show how valuable the coal from the Lower Karharbari seam is. The analyses given in this paper indicate that parts of this seam are, from a metallurgical point of view, yet more valuable than was previously thought. To bring out this point a little more clearly the following data have been added for those conversant with the technical considerations prevailing in the iron and steel industry of India.

† It may be mentioned that 100 tons of coal produce quite 75 tons of Giridih coke so that the reserves of low-phosphorus metallurgical coke will be roughly 6,720,000 tons.

(a) Estimated Production of Bessemer-quality Pig Iron.

By Bessemer pig is meant a cast iron with less than 0·06 per cent. of phosphorus and having a composition similar to A (see below) as against B which is a highly phosphoric pig iron.

—	A.	B.	C.	D.
	Per cent.	Per cent.	Per cent.	Per cent.
Graphite	2·60	2·68	3·13	
Combined carbon . . .	1·20	..	0·23	
Silicon	1·78	0·11	2·25	2·50 and over.
Sulphur	0·02	0·04	0·022	0·025
Phosphorus	0·04	3·29	1·20	0·35 to 0·40
Manganese	0·13	3·84	1·40	1·25 to 1·50

C. Grades 1, 2 and 3, pig iron made by the Bengal Iron Co., at Kulti.
D. Grade 1, pig iron made by the Tata Iron and Steel Co., at Jamshedpur.

Assuming that one ton of coke smelts $1\frac{1}{2}$ tons of ore and requires $\frac{1}{2}$ ton of limestone to produce 1 ton of pig iron, it is evident that the 8,960,000 tons of coal, which give 6,720,000 tons of coke, are capable of smelting 10,080,000 tons of ore and yielding 6,720,000 tons of iron.

An annual production of pig iron corresponding to the annual output of coal, as previously estimated, would be 336,000 tons. This output could be maintained for 20 years if all the coal of low phosphorus content in Karharbari Colliery were used for the production of pig iron of Bessemer quality.

(b) The Manufacture of Ferro-manganese.

The European standard of quality for the ferro-alloy, averaging 78 to 80 per cent. of manganese, stipulates that it should contain 0·3 or less than 0·3 per cent. phosphorus to be of the highest grade.

In the manufacture of this high-grade ferro-manganese 3 tons of coke normally smelt 2 tons of ore, with a limestone flux, and yield 1 ton of 78-80 ferro-manganese.

This means that the 8,960,000 tons of Karharbari coal (6,720,000 tons of coke) will be capable of smelting 4,480,000 tons of good quality manganese ore and yielding 2,240,000 tons of ferro-manganese.

If all the Karharbari low-phosphorus coke, produced from the annual output of coal as previously estimated, is used in the manufacture of ferro-manganese the annual production of this alloy will be 112,000 tons. This output can be maintained for 20 years.

(c) *Typical Indian Iron-ores.*

——	1	2	3	4	5
Metallic iron . . .	59·78	66·78	64·00	66·35	69·21
Phosphorus . . .	0·078	0·044	0·05	0·058	0·005
Sulphur	..	..	0·002	0·108	0·012
Silica, etc. . .	5·16	1·49	3·53	1·44	0·82
Manganese . . .	0·61	0·192	0·04	0·151	..

1. *Gurumahisani* (*Mayurbhanj*).—Ore average of 5 years output (H. C. Jones, *Rec. Geol. Surv. Ind.*, LVII, 1925); sulphur not stated, probably 0·028 ?; used by the Tata Iron and Steel Co., Ld.

2. *Sulaipat* (*or Okampad*) (*Mayurbhanj*).—Average ore shipped in 1923 (*op. cit.*, p. 146); sulphur not stated; used by the Tata Iron and Steel Co., Ld.

3. *Pansira Buru* (*Singhbhum*).—Ore average analysis (*op. cit.*, p. 134): SiO_2 2·10, CaO 0·15, Al_2O_3 1·25, MgO 0·18, MnO 0·05 per cent.; used by the Bengal Iron Co., Ld. and also by the Indian Iron and Steel Co., Ld.

4. *Rajhara* (*Drug*).—Average of 64 samples (*op. cit.*, p. 154); 2½ million tons reported below Bessemer limit of phosphorus.

5. *Lohara* (*Chanda*).—Pipalgaon is reported to be better; 100 million tons estimated at Lohara; some of the Lohara ore is reported to have been employed by the Tata Iron and Steel Co., Ld., for the production of pig iron of Bessemer quality.

N.B.—Jamda (Barabil area, Keonjhar); iron ore, with 65 Fe and P 0·05 to 0·025, is supplied to the Shell Factory at Ishapur under guarantee that the phosphorus will not exceed 0·05 per cent.; over 10 million tons of this quality are said to have been located to the west of Barabil.

The following are typical foreign iron ores used for smelting:

Iron.	Phosphorus.	Sulphur.	Country.
61·17	0·004	*Nil.*	English. Best Cumberland hæmatite.
38·2	0·31	0·12	English. Dry Northampton carbonate ore.
47·06	0·019	0·04	Spanish. Best Rubio (Bilbao).
54·65	0·014	0·04	Spanish. Calcined Bilbao spathic ore.
68·70	0·02	0 05	South Australian. Iron Knob hæmatite used by Broken Hill Proprietary Co. at Waratah, Newcastle, N. S. W.
58·54 to 68·20	0·016 to 0·56	Trace to 1·27	Nova Scotia hæmatite from the Beaton deposits.
58·83	0·62	0·069	U. S. A., Mesabi hydrated hæmatite.
58·60	0·211	0·012	U. S. A., Marquette, Swanzy ore.
52·23	0·074	0·012	U. S. A., Menominee.
52·0	0·012	0 03	Algeria, Affalou, Department of Constantine.

(*d*) *Indian Limestone used as Flux.*

	1	2	3	4
Calcium carbonate . . .	91·80	95·80	53·57	94·5 to 96·8.
Magnesium carbonate . . .	1·70	2·25	43·77	
Phosphorus *	?	?	?	traces.
Sulphur	?	?	?	
Silica	5·15	2·70	2 to 3†	2 to 2·5.
Alumina	0·52	0·80	0·70	3 to 1·2.
Ferric oxide	0·32		1·00	
Ferrous oxide	0·25	..	..	
Moisture or H_2O . . .	0·10	..	..	

* Phosphorus content from Gangpur material roughly 0·015. Amounts in other cases unknown.

1. Sutna limestone as used previously by the Bengal Iron Co., Ld., at Kulti. (J. Coggin Brown; *The Mining Magazine*, June, 1921).
2. Bisra limestone from Paraghat and Baraduar, used by the Bengal Iron Co., Ld., Kulti. (H. C. Jones; *Rec. Geol. Surv. Ind.*, LVII, 1925, p. 133).
3. Gangpur dolomite used by Tata and Sons Ltd., at Jamshedpur. (J. Coggin Brown; *op. cit.*).
4. Kandara, Chanda. Details not known. (C. S. Fox; *op. cit.*).

† Insoluble (silica) residue.

(*e*) *Analyses of Manganese ore as received at Middlesborough* (*1897—1906*). (*See Mem. Geol. Surv. Ind., XXXVII, pt. 3, 1909, p. 517, etc.*).

Mn.	Fe.	P.	Moisture.	From.
50·49	6·26	0·126	0·72	India.
45·28	0·76	0·147	8·67	Russia, Caucasus.
44·6	3·35	0·046	11·35	Brazil.
47·51	0·41	0·015	1 01	Chili.

The following were buyers' stipulations [1] about the years 1907 to 1909 as regards manganese ore from India :

Mn.	Fe.	P.	Moisture.	From.
52 to 54	4 to 6	0·07 to 0·08	6 to 7	Nagpur, Balaghat, Bhandara, Central Provinces Prospecting Syndicate.
51 to 52	6 to 7	0·09 to 0·11	7 to 8	1st grade, Nagpur, Bhandara, Central India Manganese Co.
46 to 48	6 to 8	0·03 to 0·17	9 to 11	2nd grade, Nagpur, Bhandara, Central India Manganese Co.
50 to 52	5 to 6	0·11 to 0·14	6 to 8	Nagpur, Indian Manganese Co.
44 to 46	13 to 16	0·05 to 0·06	2 to 6	Sandur, Jambon et Cie.

Fluxes in Iron Smelting.

The impurities in the ore and the ash in the fuel are, in blast furnaces, usually removed in the form of a fusible slag. This slag normally has the composition of a mono-silicate $2Al_2O_3$. $3SiO_2$+ 2MO. SiO_2, where MO represents lime (CaO) and magnesia (MgO).

[1] *Loc. cit.*, p. 514. Manganese ores, evidently in limited quantities, have been found in India with less than 0·1 per cent. of phosphorus but no guarantee is now (1926) apparently given that such ores will be supplied with less than 0·12 per cent. of phosphorus.

It is conceivable that the constituents in the ash and the gangue of the ore may be just correct to produce a monosilicate slag; if not a flux must be added. This is done according to calculations based on the following proportions for mono-silicates :—

(*a*)	2 Al_2O_3	requires	3 SiO_2
or	204 „	„	180 „
or	1 „	„	0·882 „
or	1·13 „	„	1 „
(*b*)	2 CaO	„	1 SiO_2
or	112 „	„	60 „
or	1 „	„	0·535 „
or	1·86 „	„	1 „
(*c*)	2 MgO	„	1 SiO_2
or	80 „	„	60 „
or	1 „	„	0·75 „
or	1·33 „	„	1 „

N.B.—For sesquisilicates multiply the figure for SiO_2 by 1·5, for bisilicates by 2.

To take the case of a typical iron ore—Pansira Buru—which contains :—

Fe 64 per cent., SiO_2 2·1 per cent., Al_2O_3 1·25 per cent., CaO 0·15 per cent. and MgO 0·18 per cent.

and (A) a typical coke (Bararee, ash 15 per cent.) which has as impurities :—

Fe_2O_3 0·719 per cent., SiO_2 6·255 per cent., Al_2O_3 5·013 per cent., CaO 1·039 per cent. and MgO 0·473 per cent.

or another (B) (Rannagar, ash 18 per cent.) which has as impurities :—

Fe_2O_3 2·057 per cent., SiO_2 9·684 per cent., Al_2O_3 4·620 per cent., CaO 0·594 per cent., and MgO 0·252 per cent.

(The percentage of phosphorus in both these cokes is about the same roughly—0·12 per cent.).

or (C) Giridih coke (Jubilee Pit, Karharbari colliery, ash 6 per cent.) :—

Fe_2O_3 0·656 per cent., SiO_2 4·88 per cent., Al_2O_3 2·01 per cent., CaO 0·112 per cent., MgO 0·097 per cent., P in coke 0·0065 per cent.

(A) Now making a fair guess that with any of the above cokes the proportion of fuel is 21 parts to every 32 of ore, then using Bararee coke the impurities in the charge will be :—

	In the ore.	In Bararee coke.	Total.
SiO_2 . .	·672	1·313	1·985
Al_2O_3 . .	·400	1·053	1·453
CaO . . .	·048	0·218	0·266
MgO . . .	·058	0·099	0·157

However, 1·453 parts of Al_2O_3 require 1·248 parts of SiO_2.
0·266 „ CaO „ 0·142 „ „
and 0·157 „ MgO „ 0·118 „ „
i.e., the bases present „ 1·508 parts of SiO_2.

There remains an excess of 0·477 part of SiO_2, which can be fluxed with 0·865 part of CaO, corresponding to 1·606 parts of $CaCO_3$. So that for every 21 tons of coke and 32 tons of ore a little over 1·6 tons of lime-stone will be necessary as flux.

(B) If we use Ramnagar coke the impurities in the charge will be :—

	In the ore.	In Ramnagar coke.	Total.
SiO_2 . . .	0·672	2·033	2·705
Al_2O_3 . .	0·400	0·970	1·370
CaO . . .	0·048	0·125	0·173
MgO . . .	0·058	0·053	0·111

However 1·370 parts of Al_2O_3 require 1·196 parts of SiO_2.
0·173 part of CaO requires 0·092 part of SiO_2.
and 0·111 „ MgO „ 0·083 „ „
i.e., the bases present require 1·371 parts of SiO_2.

There remains an excess of 1·334 parts of SiO_2, which require about 2·492 parts of CaO or roughly 4·643 parts of $CaCO_3$ or 4·543 tons of limestone as flux.

(C) With Giridih coke from Jubilee Pit, Karharbari Colliery, using ore to fuel in the same proportions of 32 to 21 the impurities in the charge will be :—

	In the ore.	In Giridih coke.	Total.
SiO_2 . . .	0·672	1·024	1·696
Al_2O_3 . .	0·400	0·422	0·822
CaO . . .	0·048	0·023	0·071
MgO . . .	0·058	0·020	0·070

However, 0·822 part of Al_2O_3 requires 0·805 part of SiO_2.
0·071 „ CaO „ 0·036 „ „
and 0·070 „ MgO „ 0·052 „ „
i.e., the bases present require 0·893 „ SiO_2.

There remains an excess of 0·803 part of SiO_2; this is satisfied with 1·494 parts of CaO, or 2·774 parts of $CaCO_3$ or 2·774 tons of limestone as flux.

5. Source of the Phosphorus.

It was Sir Thomas Holland[1] who first drew public attention to the highly phosphoric nature of the mica-peridotites of Giridih. This remarkable characteristic was found to be generally true of the coal-fields of the Damuda valley. In the case of two Giridih specimens collected underground he found 5·234 per cent. P_2O_5 (equivalent to 11·426 $Ca_3P_2O_8$) in the one and a slightly smaller (10·66 per cent $Ca_3P_2O_8$) in the other. He states in the first paper (p. 135) quoted above that "The decomposition of large quantities of this rock at the surface must contribute sensibly to the fertility of the neighbouring soil; but though the quantity of the lime phosphate would be considered large enough to warrant remark from the petrologist, it would not be sufficient to justify raising for economic purposes." Under the microscope the presence of the mineral apatite indicates that it is in this substance that the phosphorus is chiefly located.

Quite recently the Agricultural Department of Bihar and Orissa have been conducting a soil survey of South Monghyr and East Gaya. They have found a tract, from Nawada westward for 20

[1] *Rec. Geol. Surv. Ind.*, XXVII, pt. 4, 1894, p. 129; also XXVIII, pt. 4, 1895, p. 121, and XXX, pt. 3, 1897, p. 113.

miles, in which the phosphoric content is appreciably higher than in the lands to the eastward. In the west, in *rabi* lands, there is 0·094 per cent. P_2O_5, of which only 0·017 per cent. is available, as against 0·031 per cent. P_2O_5 of which only ·0029 per cent. is available in similar soils of the eastern areas. They say "This high phosphoric tract is watered by the rivers Tilaiya and Dhanarji which have their sources in the district of Hazaribagh in the neighbourhood of mica-bearing pegmatite rocks such as not infrequently contain apatite. In the Gaya district the Tilaiya also receives the drainage from the tourmaliniferous mica rocks near Banskap and Singar which are known to contain triphite, a phosphate fluoride of iron and manganese. The products of disintegration of these rock phosphates have presumably increased the amount of the soil phosphates in this region."

This is an interesting aspect of the case as the rocks mentioned by the Agricultural Department are far older than the coal-bearing strata of Giridih, whereas the mica-peridotite dykes are much younger. It is conceivable that there are other rich phosphate-rocks, *e.g.*, the apatite-rock of Dhalbhum, which lay within the drainage area of the great basins or valleys in which the Damuda coal seams accumulated. Thus there is the possibility that the plants of that geological period were enriched with phosphorus from the soils of that land region. The question which we have to answer is—Has the phosphorus in the coal entered as a constituent of the original plant material or is the phosphorus secondary, having been subsequently introduced by percolating waters?

According to M. Carnot (*Compt. Rend.*, Vol. 99, p. 154) spores and pollen-grains are the principal carriers of phosphorus contained in the coal and consequently in the resulting coke. As regards the phosphorus in the plant material the following extracts[1] are of considerable interest—"The cryptogams—that is to say, ferns, equisetums, and lycopods (lepidodendra and sigillaria)—along with some conifers (cordaites), constitute the bulk of the carboniferous flora, and these contain, as a group, a more or less considerable quantity of phosphorus. Carnot attempted to trace a connection between the quantity of phosphorus contained in coals and the nature of the plants of which they are composed. In the same deposit he could detect no appreciable differences, but those coals which contained

[1] 'Chemistry of Coke,' 1904, p. 117, W. Carrick Anderson.

a large number of spores, such as cannel coal, were found to contain the largest quantities of phosphorus. The amounts varied from ·00572 to ·06275 part of phosphorus in 100, while 0·02 part might be regarded as the mean."

"At the Denain Iron Works.....a comparison was made of various coals belonging to that locality with reference to the quantity of volatile constituents and of phosphorus they contained. Nothing definite, however was arrived at.....Generally speaking, the quantity of phosphorus is very variable."

There can be little doubt that some of the phosphorus in the Damuda valley and Giridih coals must be primary, *i.e.*, a constituent of the original plants. However, the following observations made by Dr. E. Spencer[1] are convincing in regard to the presence of secondary phosphorus in the coal seams of Jharia :

A. Analysis of spherulites in coal from the Nakari Nala, South Karanpura Coalfield.
B. Analysis of nodule of spherulitic material from Loyabad colliery, Jharia coalfield.

	A.	B.
SiO_2	0·22	0·69
Al_2O_3	0·39	0·82
Fe_2O_3	6·82	2·86
FeO	48·70	46·62
MnO	0·05	0·06
CaO	1·95	4·80
MgO	1·60	1·80
P_2O_5	0·28	2·85
CO_2 (calculated)	32·92	31·60
Moisture	0·20	0·11
Insoluble in acid	6·31	6·35
	99·44	98·56

Dr. Spencer, speaking of the Loyabad material says "The dense interstitial coaly matter between the spherulites is broken up by numerous shrinkage cracks, which have developed subsequently to the growth of the spherulites. These cracks have been filled in with calcium phosphate, which mineral also occurs in the cracks and cavities of the outer zones of the spherulites." Speaking of analyses A and B he says of B "Except for the secondary calcium phosphate present in this material, the composition compares closely with that of the Karanpura spherulitic rock."

[1] *See his paper "On Some Occurrences of Spherulitic Siderite and other Carbonates in Sediments," Q. J. G. S., Vol. LXXXI, 324, pt. 4, 1925, pp. 667-705.*

It is well known that apatite is partially soluble in such waters as would percolate through coal seams. Sir Thomas Holland says (*op. cit.* p. 135):—"It seems natural to expect that slow oxidation of the coal by oxygen dissolved in circulating underground waters would result in the production of carbonic acid and consequent formation of carbonates for decomposing silicates of iron, lime and magnesia."

If we can now show that the phosphorus content of mica-peridotite in a coal seam high in phosphorus and at some depth from the surface is apparently less than another specimen also below ground but associated with the same coal seam which is here lower in phosphorus, then the source of this element should be evident. Sir Thomas Holland's highly phosphatic peridotite (5·234 per cent. of P_2O_5) came from the shaft of the Jubilee Pit in Karharbari colliery, Giridih. An analysis of the coal from this area has been given and shows a very low phosphorus content.

Sir Thomas Holland did not include complete analyses of his specimens and, as I could not trace any such analyses in the Geological Survey Laboratory Book of that period, I presume the chemical investigations were made by Dr. P. Brühl. It is therefore fortunate that I procured from Dr. Brühl in 1912 the following analysis:

Analysis of Mica-Peridotite, Giridih Coalfield. By Dr. P. Brühl, at Sibpur.

Analysis on sample dried at 105°C.—H_2O 2·60 per cent. Rock obviously deeply altered, although hand specimen fairly fresh looking.

SiO_2	40·50	
TiO_2	4·30	
Al_2O_3	5·00	approx.
Fe_2O_3	7·00	"
FeO	6·30	
MgO	11·80	
CaO	9·00	
K_2O	4·36	; largely in hydro-biotite.
Na_2O	3·18	
P_2O_5	1·81,	as apatite.
V_2O_5	·02	
Cr_2O_3	·035	
F	·20	
Cl	·017	
CO_2	3·70	; partly in dolomite or calcite.
H_2O (above 105°)	2·70	
	99·922	

In this analysis the P_2O_5 percentage is less than 2 ($Ca_3P_2O_8$ equivalent about 3·6) but the rock, in the slides examined by me, is decidedly not fresh, nor is the exact source of the specimen known. To obtain more suitable information I had the following analyses made—

Analyses of Mica-peridotite Dykes.

	I P. C. R.	II P. C. R.	III S. K. C.	IV S. K. C.	V P. C. R.
SiO_2	44·26	27·78	44·21	36·53	31·81
TiO_2	6·73	3·48	2·24	1·80	3·98
Al_2O_3	12·09	7·33	9·11	14·08	10·88
Fe_2O_3	2·30	4·70	3·77	5·63	2·13
FeO	8·22	6·82	8·07	6·26	5·43
MgO	9·50	16·95	7·84	7·20	8·79
CaO	6·46	10·02	7·60	8·51	8·51
Na_2O	1·38	0·75	1·29	1·70	1·41
K_2O	1·12	3·77	4·73	1·18	3·53
H_2O (moist.)	5·00	1·06	3·01	5·70	0·13
H_2O (comb.)	0·89	1·39	0·38	1·05	0·29
CO_2	nil	11·91	4·99	6·14	18·41
P_2O_5	2·14	4·38	2·77	4·13	4·75
TOTAL	100·08	100·34	100·01	100·01	100·05
Sp. Gravity	2·533	3·01	2·72	2·60	2·863

P. C. R.—Mr. P. C. Roy, Assist. Curator, Geological Survey of India.

S. K. C.—Dr. S. K. Chatterjee, Assist. Supdt. Geological Survey of India.

I. Greatly altered mica peridotite from workings of Central Pit, Serampur Colliery, Giridih Coalfield.

II. Typical Mica-peridotite, Mugma area, Raniganj Coal-field.

III. Mica-peridotite from Bahira Colliery, near Kulti, Raniganj Coal-field.

IV. Peridotite dyke with mica in Dishargarh seam, Dharma Nala, Raniganj Coal field.

V Peculiar apple green peridotite dyke in 14 seam Bhalgora colliery, Jharia Coal-field.

N.B.—All the analyses show traces to ·17 per cent. (IV) MnO; BaO is also present when looked for; sulphur was noted (0·24 per cent) in I. In none of the samples could any peridote (olivine) or recognisable augite be detected in microscope sections. Bronze mica is present abundantly in I, II and III, less so in IV and almost absent in V. Apatite is common in all, but is most conspicuous in II, IV and especially V. Serpentine is seen in almost all the slides. Its occurrence appears to be intimately related to areas in which olivine has decomposed and also to patches in which calcite (dolomite) is now present. Specimen I appears to have been severely leached of soluble constituents by percolating water. Specimen V effervesces with acid. In my opinion the bronze mica is a paramorphic mineral of an original peridotite, whereas the dykes and sills as now found are so altered that the term peridotite is misleading.

The phosphorus content of the analysis of I, from North Central Pit, agrees very well with that by Dr. Brühl and is lower than that from the Jubilee Pit. It has been shown that the phosphorus content of the coal seam in this neighbourhood is considerably higher than that of the same coal seam at the Jubilee Pit. We are presuming of course that the phosphorus content of the peridotites is fairly constant. Nevertheless the peridotite from North Central Pit although collected 500 feet below ground is greatly altered and has obviously been subject to the leaching action of percolating waters. I would draw attention to the fact that the workings, particularly the eastern and south-eastern workings, of Serampur colliery (see Plate 27) are subject to the percolation of considerable quantities of water which finds its way along the seam from its outcrop and the faults to the east and north-east.

It is not to be forgotten that the dolerite dykes may not be above suspicion in this connection, because it is quite certain that their physical effects in coking the coal are not the only effects they produce. In the vicinity of Rawanwara, Chhindwara District, Central Provinces, I found a deeply decomposed dolerite dyke in association with which in the adjoining shales there was a marked development of fluorspar. It appeared as though the fluorine had come from the igneous intrusion. Unfortunately I have not been able to complete an analysis of the olivine-dolerite dyke near the Deep Pit, Serampur colliery, Giridih, but the following analysis by H. S. Washington (*Bull. Geol. Soc. Amer.*, Vol. 33, 1922, p. 774) of doleritic basalt "I" of about the same age from the Rajmahal Hills (Ramchanderpur) shows a higher phosphorus content than similar material "II" from the Central Provinces (Bhourameta Hill, Chhindwara).

	I.	II.
SiO_2	53·45	49·98
Al_2O_3	15·24	12·51
Fe_2O_3	1·26	2·83
FeO	8·20	11·71
MgO	5·83	5·42
CaO	9·32	10·00
Na_2O	3·03	2·65
K_2O	1·12	0·30
H_2O+	0·56	0·95
H_2O-	0·47	0·24
TiO_2	0·50	2·27
P_2O_5	0·78	0·37
MnO	0·13	0·23
Total	99·89	99·55

To appreciate to the full the exceptional character of the dolerite and mica-peridotite igneous rocks of Bengal and Bihar, as regards their phosphorus content, it may be stated that the mineral apatite, which is the chief phosphorus-carrying mineral of rocks, is most common in the gneisses and such like metamorphic rocks; that it is more common in granites and acid igneous rocks than in basalts and dolerites; and that it is generally considered to be a relatively *rare constituent* in peridotites. In their paper "The Composition of the Earth's Crust"[1] Drs. F. W. Clark and H. S. Washington calculate the phosphorus percentage (given as P_2O_5) in the average composition of igneous rocks as 0·14. From these data it would appear that the Coal-Measure strata of the Damuda valley and adjacent coalfields not only lie in a tract containing rocks rather higher in phosphorus than the normal, but are also intruded by dykes of igneous rock of exceptionally high phosphorus content. It is therefore not remarkable that the coal seams contain somewhat higher amounts of phosphorus than is considered normal elsewhere, and it must be assumed that to find coal with a low phosphorus content in the Damuda valley coal-fields will be quite exceptional. If this deduction is quite logical, as it appears to be, the arguments in favour of conserving the low phosphorus coal in Karharbari Colliery are unanswerable.

I am very grateful to numerous friends for their kind assistance in constructing this paper. Mr. C. S. Whitworth has supplied a number of valuable analyses; Dr. E. Spencer has also provided me with several analyses of coal and other data; Mr. F. G. Percival has been generous enough to secure the analyses of the coal used at the Agricultural Implements Co.'s. works. The analyses of the Indian mica-peridotites were carried out in the Geological Survey Laboratory by Dr. S. K. Chatterjee and Mr. P. C. Roy, to whom I am greatly obliged. It is, however, not too much to say that, without the detailed analyses made for me by Mr. A. Dawes Robinson and the very liberal help given by Mr. H. Lancaster, this paper could not have been prepared.

[1] Prof. Paper No. 127, 1924, Dept. of the Interior, U. S. Geol. Surv.

THE DISTRIBUTION OF THE GAULT IN INDIA.

BY G. de P. COTTER, B.A., SC.D., M.INST.M M., M.INST.P.T., *Superintendent, Geological Survey of India.*

THE recent discovery by Major L. M. Davies of a Gault fauna in the Samana range in the tribal territory west of Kohat has led me to review our knowledge of the Gault in India.[1]

That a Gault fauna existed in the Samana range has long been suspected. In 1891, during the Miranzai expedition under General Lockhart, a number of fossils believed to be of Cenomanian or Gault age were sent to the Geological Survey Office by Major Mainwaring.[2] They are mentioned by Middlemiss in his memoir on Hazara, in which he expresses the opinion that the Samana fauna is of similar age to a fauna which he himself had collected from the Giumal Sandstone of Hazara, and he regarded both as of Cenomanian age. He notes however that Waagen and Wynne had favoured a Gault age for the fossiliferous beds of this horizon in Hazara.[3] C. L. Griesbach accompanied the Miranzai expedition for geological investigation. His notes on the range are, however, very fragmentary[4] and little was added to our knowledge of the Cretaceous of that area. Subsequently Sir H. H. Hayden was deputed to accompany the Tirah Expeditionary Force in 1897, and collected brachiopoda and belemnites which were referred to the Cenomanian by Nœtling.[5]

Up till 1917 the age of the Hazara and allied faunas was believed to be Cenomanian, in accordance, with the view of C. S. Middlemiss. But during the years 1915 to 1917, with the assistance of Mr. Bankim Behari Gupta, now Sub-Assistant, Geological Survey of India, I was engaged in overhauling the collections of Indian fossils in the fossil gallery of the Indian Museum. During the re-examination of our collections, it became necessary to check the identification of many species, both in cases where the identification appeared incorrect or where the original generic or specific name had been changed. Several changes of a more important kind were made;

[1] *Rec., Geol. Surv. Ind.*, LIX, p. 15.
[2] *Mem., Geol. Surv. Ind.*, XXVI, p. 38.
[3] See Waagen and Wynne; Geology of Mt. Sirban, *Mem., Geol. Surv. Ind.*, IX, p. 342.
[4] *Rec., Geol. Surv. Ind.*, XXV, p. 80.
[5] *Mem., Geol. Surv. Ind.*, XXVIII, p. 104.

thus the subdivisions and stages of the Gondwana system were revised; the marine Permian was exhibited separately from the Carboniferous. Amongst the changes introduced was the transfer from the Cenomanian to the Gault of C. S. Middlemiss' collections from the Giumal Sandstone of Hazara. An intensive study of the fauna by Mr. Gupta and myself showed that the fauna was most closely related to the lower Gault of Europe. Amongst the species provisionally identified and exhibited in the Museum show-case in 1917 were:--

Douvilleiceras mammillatum (Schlotheim), *Acanthoceras lyelli* Leym, *Pholadomya genevensis* Pict. & Roux, *Terebratula obesa* Sow., *Turbo gresslyanus* Pict. & Roux, and *Solarium moniliferum* Mich. All the above came from a single locality, the village of Jabrian on the Haro River (Survey sheet 13 $\frac{G}{1}$; lat. 33° 47′; long. 73° 14′). The section is described on page 200 of C. S. Middlemiss' memoir.[1]

In addition to these from Jabrian other specimens collected by Middlemiss were identified and exhibited as follows:— *Mortoniceras inflatum* Sow., *Hamites attenuatus* Sow., from a village named Wijjian (lat. 33° 17′; long. 72° 19′), *Mortoniceras inflatum* Sow. from Dhantaur (lat. 34° 7′ 30″; long. 73° 16′,) *Terebratula biplicata* Brocchi, from Janomar Hill (lat. 33° 47′; long. 73° 0′ 30″).

When writing this paper, I again checked these identifications, and find it necessary to make some changes. I sub-join some notes on the fauna, with such revisions as I have adopted.

Douvilleiceras mammillatum (Schl.):—

There appears to be no doubt in regard to the identification of this species. The number of ribs on the last whorl of the Hazara specimens varies from 18 to 30. D'Orbigny (*Palæontologie Française*) states that the number of ribs varies from 16 to 30. Pictet, in his description of the Swiss Albian fauna,[2] mentions that the ribs on his specimens vary from 16 to 25. Four out of six of our specimens have ribs of numbers between 26 and 30 on the last whorl, and therefore it is to be remarked that the variety with more numerous ribs appears to be more characteristic of the Jabrian locality. The fossils are casts, and the spines are not preserved.

[1] *Mem., Geol. Surv. Ind.*, XXVI.

[2] F. J. Pictet and W. Roux: Description des Mollusques fossiles des grès verts des environs de Genève: *Mem. Soc. phys. et hist. nat. Gen.*, XI, p. 257; XII, p. 157; XIII, p. 389.

Acanthoceras lyelli Leym. :—

There are seven well-preserved casts, all from Jabrian. The fossils agree exactly with the type figures.

Pholadomya genevensis Pict. and Roux :—

The Indian species is apparently very closely related to Pictet and Roux's type. I am not, however, certain whether it is to be regarded as identical, and consider it safer to describe it as *P.* sp., cf. *genevensis*. In *P. genevensis* the postero-dorsal profile is slightly convex; in the Indian species it is flat or very slightly concave in this region.

Terebratula obesa Sow. :—

The species may be compared to Stoliczka's figures in Plate V, figures 5*a*, 5*b*, and 5*c* of his "Cretaceous Fauna of Southern India", Vol. IV. I doubt, however, whether the species can be separated from *T. biplicata*, var. *dutempleana* D'Orb. The figures 1-9 in Plate VI of Davidson's "British Fossil Brachiopoda" appear to agree. I prefer to call the Indian species *T. dutempleana* D'Orb.

Turbo gresslyanus Pict. and Roux :—

The specimens are merely casts and cannot be identified with certainty. They may be described as *T.* sp. cf. *gresslyanus*.

Solarium moniliferum Mich. :—

Although the specimens are generally casts, traces of the ornamentation are preserved. The identification appears correct.

Mortoniceras inflatum Sow. :—

Two specimens were referred to this species, one from Wijjian, and the other from Dhantaur. The specimen from Dhantaur is a large ammonite, 15 cms. in diameter. The identification appears correct, but the name *Mortoniceras* should now be changed to *Inflaticeras*.[1] The specimen from Wijjian is an *Inflaticeras*, but I think it possible that it is a different species from *I. inflatum*. Only a small portion of the outer whorl is preserved; this shows irregularly bifurcating ribs without tubercles. The fragmentary condition renders precise identification impossible, but a comparison may be made with *Inflaticeras inflatum* Sow.

The Jabrian fauna with *Douvilleiceras mammillatum* and *Acanthoceras lyelli* must be regarded as lower Gault in age and appears

[1] C. Stieler: Ueber sogenannte Mortoniceratenarten im des Gault: *Centralblatt für Min.*, (1920). p. 392.

to be precisely the equivalent of Major Davies' Samana beds. The Wijjian ammonites are, however, more suggestive of the Vraconnian (upper Gault to basal Cenomanian). The same may be said of the Dhantaur ammonite. The single brachiopod from Janomar Hill does not help us to fix any precise age, but it agrees very well with the general age of the Hazara Cretaceous.

North-west of Rawalpindi, Wynne obtained from the Giumal Sandstone two *Trigoniæ*, viz. *T. ventricosa* and *T. costata.*[1] *T. ventricosa* is a Neocomian form from the Umia beds of Kachh. As regards *T. costata*, this, I think, merely means that the *Trigonia* in question belongs to the section *Costatæ*. If so, it does not give any precise definition of age. In Kachh the section *Costatæ* ranges from the Putchum to the Umia groups.

In the Attock district, Mr. Lahiri found a *Perisphinctes* in the Giumal Sandstones, which, although not too well preserved, appears to be very close to, if not identical with, *P. bleicheri* de Loriol, a species from the Umia beds of Kachh, age basal Cretaceous.[2]

The last occurrence coupled with the *Trigoniæ* noted above would seem to show that the Giumal Sandstone ranges down to the lower Cretaceous, while the ammonites of Hazara indicate that horizons as high as lower Cenomanian may be expected.

Sir H. H. Hayden's Cretaceous fossils from Tirah are rather too fragmentary for identification. Amongst them are specimens of a *Rhynchonella* very close to *R. mutua* Stol. and of *Terebratula dutempleana* from the Waran valley; several belemnite fragments, a *Terebratula*, probably *T. dutempleana*, and some ammonite fragments from the road leading from the Arhanga Pass into Maidan; and several very poorly preserved fragments of a *Perisphinctes*-like ammonite from other localities.

The Giumal Sandstone of the Himalaya has been studied by A. Spitz, whose paper in the Records of the Geological Survey of India[3] shows that the fauna ranges from Neocomian to Cenomanian. One species—*Parahoplites* sp.—has its nearest relatives in the lower Gault and Aptian; another, *Stoliczkaya dispar*, indicates a Vraconnian horizon.

In the peninsula of India, in the state of Gwalior, the Bagh beds contain a fauna which has been studied by E. Vredenburg

[1] See *Mem., Geol. Surv Ind.*, XL, p. 384 and references.
[2] See *Pal. Ind.*, Ser. IX, Vol. I, p. 194, Plate LV, fig. 4.
[3] Vol. XLIV, p. 197 *et seq.*

and R. Fourteau.[1] From the researches of the latter it appears that the Bagh Bed fauna is to be regarded as upper Gault or Vraconnian in age, and therefore to be correlated with the *Inflaticeras inflatum* horizon of Hazara.

Inflaticeras inflatum is also reported from Sandoway district on the Arakan coast, from the Cretaceous rocks of that area.[2] There is also the rather doubtful occurrence of a species of *Placenticeras* from Ramri Island,[3] which would indicate a Cenomanian horizon.

The Cretaceous of Southern India commences with the Cenomanian and ranges to the Danian, with a rich fauna. On the other hand, in Baluchistan the middle Cretaceous is entirely absent.[4]

In the Salt Range E. Koken[5] showed that the Cenomanian was missing, and that the lower Cretaceous marls and white sandstone were overlain by the Danian *Cardita beaumonti* beds.

In Sind the lower Cretaceous and Danian are developed, but the Cenomanian is missing.[6]

In Kachh the lower Cretaceous (Umia beds) is developed but the rest of the Cretaceous is missing.

Reviewing these facts, it is remarkable that while the Cenomanian is richly developed in the *continental* area of Southern India, it is missing from the *geosynclinal* areas of Kachh, Sind, Baluchistan, and the Punjab. This is an example which supports E. Haug's dictum in his Traité dé Géologie (vol. I, p. 505). "Toutes les fois qu'un terme déterminé de la série sédimentaire est transgressif sur les aires continentales, le même terme est en régression dans les géosynclineaux." If it is true that the marine transgression of the Cenomanian was accompanied by oscillations in an inverse sense in the geosynclinal part of India, it appears that the Gault, being an age of transition, when these counterbalancing movements were commencing, is very poorly developed both in the "continental" and "geosynclinal" areas of India.

[1] E. Vredenburg: The Ammonites of the Bagh Beds: *Rec., Geol. Surv. Ind.*, XXXVI, p. 109. R. Fourteau: Les Echinides des "Bagh Beds"; *id.* XLIX, p. 34.
[2] *Mem., Geol. Surv. Ind.*, X, p. 311.
[3] *Mem., Geol. Surv. Ind.*, XXI, p. 48 footnote.
[4] *Rec., Geol. Surv. Ind.*, XXXVIII, p. 189.
[5] *Centralblatt*, IV, 439
[6] See section facing p. 88, *Mem., Geol. Surv. Ind.*, XVII.

THE AGE OF THE SO-CALLED DANIAN FAUNA FROM TIBET.

BY G. DE P. COTTER, B.A., SC.D., M.INST.M.M., M.INST.P.T., *Superintendent, Geological Survey of India.*[1]

IN reviewing the memoir of Prof. H. Douvillé upon the Cretaceous and Eocene of Tibet (*Pal. Ind.*, New Ser., Vol. V, Mem. No. 3) M. Dolfus remarked (*Revue Critique de Paléozoologie*, XXIV, p. 66) "Il y a peu de formes admises comme provenant réellement de l'Eocène . . . . . évidemment nous sommes ici dans le Lutécien et, comme la sédimentation est concordante et continue avec les couches attribuées au Danien, il y a là une question embarrassante relativement à l'Eocène inférieur, à moins que ces couches daniennes ne soient en réalité éocéniques comme leurs Genres de Mollusques le donne à croire. Il y a là un désaccord entre les Mollusques et les grands Foraminifères qui appelle de nouvelles études et une vérification soigneuse."

M. Dolfus here suggests the possibility that the so-called Danian of Tibet may really be Eocene, as the molluscan fauna suggests. The same views were held independently by the late Mr. E. Vredenburg, who has left some scattered notes upon the subject, in which he attempts to show that the molluscan fauna of the so-called Danian is really an upper Ranikot to Laki fauna, and that the *Cardita beaumonti* horizon and lower Ranikot stage are entirely missing. I shall briefly recapitulate the main features of the geological section.

The geology of south-east Tibet was described by Sir H. H. Hayden in the *Memoirs of the Geological Survey of India*, Volume XXXVI, part 2. Prof. Douvillé gives a list of the various horizons, compiled from sections given on pages 44 and 51 of Sir H. H. Hayden's memoir. These are numbered 6 to 16, as follows :—

16 Shales and sandstones (Dzongbuk shales).
15 Orbitolites Limestone with *Alveolina*.
14 Calcareous Shales with *Spondylus*.

[1] Written partly from notes left by the late E. Vredenburg, Superintendent, Geological Survey of India.

13 Operculina Limestone.
12 Gastropod Limestone.
11 Ferruginous Sandstone.
10 Grey Limestone with Brachiopods.
9 { *Lithothamnion* Limestone. / Red sandy Limestone. / Grey Limestone.
8 Brown Limestone with *Omphalocyclus*.
7 Thin-bedded Limestone with *Vola quadricostata*.
6 Massive Limestone.
6 Calcareous Shales.

Mr. Vredenburg suggested in 1908 (*Rec., Geol. Surv. Ind.*, XXXVI, p. 189) that the Ferruginous Sandstone (No. 11 of the above table) represented the *Cardita beaumonti* horizon, and that, if the section at all resembled those of Sind and North West India, there was no difficulty in supposing that the lower Eocene, which is of extremely rare occurrence as a fossiliferous deposit in India, might be missing, and that the beds above No. 11 might belong to the widespread middle Eocene.

Prof. Douvillé, however, in the work quoted in the first paragraph of this paper, ascribes beds Nos. 12 to 14 to the Danian, as well as bed No. 11, the age of which is not determinable owing to the absence of fossils, but which, it may be admitted, may possibly be actually Danian and the equivalent of the *Cardita beaumonti* horizon[1]. The age of beds 13 to 14 is, however, in dispute, and I shall try to show that they are in reality upper Ranikot to Laki in age. The following table shows the fauna of these beds as determined by Prof. Douvillé :—

Name of fossil.	Bed 12.	Bed 13.	Bed 14.	
Nautilus pseudo-bouchardi Spendler	*	*		also in bed 9.
Nautilus cf. *rota* Stoliczka		*		
Gisortia depressa Sowerby	*			
Ovula cf. *ellipsoides* D'Archiac and Haime	*			
Terebellum distortum D'A. and H.	*			
Gosavia salsensis (D'A. and H.)	*			
Lyria sp.		*		
Chenopus tibeticus Douvillé, n. sp.	*			

[1] It might equally well be of Ranikot age.

Name of fossil.	Bed 12.	Bed 13.	Bed 14.
Chenopus (Hippocrene) columbarius D'A. and H.	*		
Drepanochilus fusoides D'Archiac			*
Campanile cf. *breve* Douvillé	*	*	
Campanile brevius Douvillé n. sp.		*	
Natica cf. *flemingi* D'A. and H.		*	
Velates tibeticus Douvillé n. sp.	*	*	
Venericardia sp.	*		
Corbis cf. *lamellosa* Lamk		*	
Lima squamifera Goldfuss		*	
Chama cf. *distans* Desh			*
Spondylus roualtì D'Archiac			*
Delhesdia haydeni Douvillé n. sp.	*		
Lepidorbitoides tibetica Douvillé n. sp.		*	
Lepidorbitoides polygonalis Douvillé n. sp.		*	*
Operculina canalifera D'Archiac		*	*
Operculina hardei D'A. and H.		*	
Siderolites miscella D'Archiac		*	*

I propose to consider each of these species, with the help of Mr. Vredenburg's notes.

Nautilus pseudobouchardi.- Prof. Douvillé notes the similarity of the Tibetan form to *N. labechei* D'A. and H., from the Laki of Sind. He states that it differs in that the whorls are less high and more flattened above. Mr. Vredenburg remarks: "It is by no means certain that this species differs from *N. labechei*; the Tibet specimen has reached a more advanced stage of growth than D'Archiac and Haime's type, and it is a common thing for *Nautili* of this group to acquire taller whorls with increasing age."

Nautilus cf. *rota.* -Mr. Vredenburg remarks: "This form does not resemble any fossil from the Danian of Sind. It is closely related to *Nautilus forbesi* D'A. and H., the commonest species of the Laki, but it has much more crowded septa."

Gisortia depressa. Mr. Vredenburg in his posthumous memoir on the genus *Gisortia* (*Pal. Ind.*, New Ser., Vol. VII, part 3) expresses the opinion that these specimens from Tibet must be referred to *Gisortia tuberculosa* Duclos, which is an upper Ranikot fossil in Sind. He notes also that the Tibetan fauna which I am now discussing is middle Eocene and not Danian. At the time of writing this paper Mr. Vredenburg's work on *Gisortia* is still in the Press.

Ovula cf. *ellipsoides.*—This is only a cast, very much resembling certain casts from the Laki of Sind. In Mr. Vredenburg's "Supple-

ment to Cossmann and Pissarro's memoir on the Mollusca of the Ranikot Series," now in the Press, it is stated that D'Archiac's species is founded upon a damaged and distorted specimen.

Terebellum distortum.—This is a very common fossil, according to Mr. Vredenburg, both in the Ranikot and in the Laki.

Gosavia salsensis.—D'Archiac and Haime's species *Voluta salsensis* is referred by Mr. Vredenburg (*Rec., Geol. Surv. Ind.*, LIV, p. 267) to the genus *Aulica* rather than to *Gosavia*. It is from the middle Eocene of the Salt Range.

Lyria sp. is too incomplete for determination, but according to Mr. Vredenburg "resembles many tertiary forms both in India and Europe."

Chenopus tibeticus is a common Laki fossil in Sind. There is a premutation in the Ranikot described by Cossmann and Pissarro *i.e.*, *Chenopus dimorphospira*. In Mr. Vredenburg's Supplement, above alluded to (not yet published) there is a comparison and diagnosis of both the Laki and the Ranikot form.

Chenopus columbarius.- The Indian species referred by D'Archiac and Haime to *Rostellaria columbaria* Lamk. is a characteristic Laki fossil.

Drepanochilus fusoides.—Mr. Vredenburg remarks: "The fossil referred by Prof. Douvillé to *Drepanochilus fusoides* differs from D'Archiac's type from the Ranikot, but corresponds with an undescribed species, very abundant in the Laki."

Campanile cf. *breve* and *C. brevius.*—Mr. Vredenburg states: "I have not noticed in the Laki any *Ceritheums* so broadly conical as *Campanile* cf. *breve* and *C. brevius* from Tibet, but similar forms occur in the Ranikot."

Natica flemingi.—Mr. Vredenburg states this to be a Laki fossil from the Salt Range.

Velates tibeticus.—This form has been already discussed by Mr. Vredenburg in his Supplement to the Ranikot Mollusca (in the press). It corresponds, in his opinion, with *V. affinis* D'Archiac and Haime, and characterises both the Ranikot and the lower zones of the Laki.

Venericardia sp., *Lima squamifera*, and *Chama* cf. *distans* are all poorly preserved specimens and are, Mr. Vredenburg thinks, "too incomplete to take into account."

Spondylus roualti.—This is a characteristic Laki form.

From the above it is clear that the mollusca indicate in the clearest manner possible the Eocene and probable upper Ranikot to Laki age of these Tibetan beds. The foraminifera, which M. Dolfus thought were in disagreement with the mollusca over the question of age, may now be examined. Yet I doubt if M. Dolfus would to-day express the same opinion as to the Cretaceous aspect of the foraminifera, since recent work has partly modified our views on the subject.

Omitting the species referred to *Delheidia* and the *Hydrozoa*, but which some have thought to be one of the foraminifera, there are two species of *Lepidorbitoides*, two of *Operculina*, and one of *Siderolites*.

Operculina canalifera is a Sind form which, according to Mr. Vredenburg, characterises the highest zone of the Ranikot. It occurs also in Burma in the Yaw stage (upper Eocene).[1]

Operculina hardei is a Sind form associated with *Nummulites garansensis* according to D'Archiac and Haime. Mr. Vredenburg notes that under this name two forms appear to have been described, one an Oligocene *Operculina* found in company with *N. garansensis*,[2] and another form which possibly is specifically distinct, and which occurs in the Ranikot.

Siderolites miscella, originally described by D'Archiac and Haime as *Nummulites miscella* is associated with Eocene fossils in Sind, and it has been explained in Mr. Vredenburg's Supplement (in the Press), that, with the exception of *Cardita beaumonti* itself, all D'Archiac and Haime's types appear to be Eocene or later. Mr. Vredenburg (*Rec., Geol. Surv. Ind.*, XXXIV, p. 86), originally regarded the species as an *Assilina* and states that it characterises the two upper zones of the Ranikot series. Nuttall (*Rec. Geol. Surv. Ind.*, LIX, p. 125), also places *Siderolites miscella* in the upper Ranikot. The two species of *Lepidorbitoides* are new and the genus has hitherto not been found in India.

Omitting for the moment such evidence as the occurrence of *Lepidorbitoides* may give, it appears that we cannot only say that we are dealing with an Eocene horizon, but can to some extent correlate the Tibetan beds with those of Sind.

[1] *Rec., Geol. Surv. Ind., XLI, p.* 238.

[2] *N. garansensis*, closely allied to *N. fichteli*, is the megaspheric form of *N. intermedius*. See *Rec., Geol. Surv. Ind.*, LIX, p. 125.

Prof. Douvillé mentions two characteristic Laki fossils from the admittedly Eocene beds, (No. 15), immediately above the beds of disputed age. They are *Vulsella legumen* and *Ostrœa flemingi*.[1] With these two molluscs is found *Alveolina oblonga*, which is found in Sind in association with *Nummulites planulatus* in the upper Ranikot.

It would appear therefore that the bed numbered 15—*Orbitolites* limestone with *Alveolina*—is not to be regarded as separable by any stratigraphical gap from the beds 12 to 14 immediately below. We appear to be dealing with a Laki horizon in the case of bed 15. *Spondylus rouaiti*, which characterises bed 14, is a typical Laki species according to Mr. Vredenburg. *Velates affinis* ranges from the upper Ranikot to the lower Laki (Meting Shales). Other species mentioned above are, as will be seen, more characteristic of the Ranikot, but there is a distinct Laki element in the fauna. *Chenopus tibeticus* has a premutation in the Ranikot, *viz.*, *Ch. dimorphospira* C. and P. It appears probable, on reviewing the whole evidence, that the nearest equivalents in Sind would be zone 4 of the Ranikot and the lower division of the Laki or the Meting Shales.

It remains to discuss the question of the presence of *Lepidorbitoides*. At the time that Prof. Douvillé wrote the memoir on the Cretaceous and Eocene of Tibet, I believe the current views were that *Orbitoides* (*s. str.*) and *Lepidorbitoides* (type *O. socialis*) were strictly Cretaceous, that *Orthophagmina* was strictly an Eocene genus, and that *Lepidocyclina* was Oligocene and Miocene.

In 1917 M. Douvillé published an account of the Stampian fauna of Trinidad,[2] in which he notes the presence in association of *Orthophagmina stellata* and *Lepidocyclina* (*Isolepidina*) *pustulosa*.

Cushman,[3] in a paper published in 1920, expresses the view that *Lepidocyclina* occurs with *Orthophragmina* in the Eocene in America, and that *Orthophragmina* is not found in Oligocene beds, which contain *Lepidocyclina* alone.

The occurrence of *Lepidocyclina* in the upper Eocene seems now to be an established fact.

[1] For the age of *O. flemingi* see *Rec., Geol. Surv. Ind.*, XLVII. p. 197. Mr. Vredenburg, in his unpublished notes, says that *Vulsella legumen* D'A. and H. is a Laki species, and replaces a Ranikot *Vulsella* which he has referred to *V. crispata* Fischer.

[2] *Comptes-Rendus Acad. Sci.*, Vol. 164, p. 841.

[3] The American species of *Orthophragmina* and *Lepidocyclina*; *U. S. Geol. Survey*, Prof. Paper 125-D.

It is probable that *Lepidocyclina* sprang from some such ancestral type as *Orbitoides* (*Lepidorbitoides*) *socialis* from the Maestrichtian, in which the equatorial chambers tend to become hexagonal. It is not difficult to suppose therefore that there may have existed in the middle Eocene some intermediate types linking *Lepidocyclina* with *Lepidorbitoides*. The two Tibetan species appear to fit into their proper places as middle Eocene species in the evolutionary tree.

There has been of late years some discussion as to whether *Orbitoides* (s. str.) passes up to the Eocene.[1] Checchia-Rispoli, who has for years resisted the view that *Orbitoides* (s. str.) is Cretaceous only, *Orthophragmina* Eocene only, and *Lepidocyclina* post-Eocene only, has recently written a somewhat controversial note,[2] maintaining his original view that all three genera can co-exist in the Eocene. He quotes with triumph Prof. Douvillé's admission that his original conclusion was "un peu trop absolue et à laquelle il a été nécessaire d'apporter des tempéraments."

A curious mixture of *Orbitoides*, *Lepidorbitoides*, and *Orthophragmina* is found in Cahetia, and is described by A. Riabinin ;[3] in this paper it is suggested that there is a mechanical mixture of Cretaceous with Eocene types. Apparently A. Silvestri has suggested a similar mixture to explain several such occurrences in Italy. In India, it is quite common to find derived nummulites in the Murree Beds and in the Siwaliks; these nummulites have been deposited in the Siwaliks and Murrees as fossils from the Eocene Nummulitic Shales which immediately underlie them. Fossil nummulites are easily transported by water, just as pebbles are transported, and become incorporated in rocks of later age.

There is no reason for regarding the Tibetan species of *Lepidorbites* as derived forms; on the other hand, it is by no means certain that *Lepidorbitoides* is as a genus strictly confined to the Cretaceous. The evidence of the Laki age of the so-called Danian of Tibet appears to be overwhelming, and there appears to be no course open but to register the Tibetan *Lepidorbitoides* as probable Eocene survivors of the genus, keeping in view the alternative

[1] There is a paper by A. Silvestri on this subject, not available in Calcutta, entitled "Orbitoidi cretacee nell' Eocene della Brianga"; *Mem., Pont. Acc. N. Lincei*, 1919, pp. 31-107.

[2] *Boll. del R. Comit. Geol. d'Italia*, Vol. XVIII, N. 7.

[3] *Bull. Com. Geol. St. Petersburg*, XXX, p. 669.

possibility that the foraminifera may partly be derived from older rocks.

One argument that might be adduced in favour of a Cretaceous age is the curious absence of nummulites. Nummulites are absent from both the so-called Danian and the admittedly Eocene beds from the base of the Gastropod Limestone to the top of the Dzongbuk Shales. This curious feature is commented upon by Sir H. H. Hayden (*op. cit.*, p. 56); nevertheless he regarded the whole series, from bed 11—Ferruginous Sandstone, to the top of bed 16—Dzongbuk Shales—as Eocene. The absence of nummulites is however a feature which may be paralleled in other areas, and Mr. Vredenburg in his unpublished notes states that he has seen similar Eocene beds without nummulites in Baluchistan.

The main evidence then of a Cretaceous age is the presence of *Lepidorbitoides*, but the two species referred to this genus are new and are not found in the Cretaceous in any other area; moreover, in view of the undoubted presence of *Lepidocyclina* in the upper Eocene and the probability that it is descended from some such ancestral form as *Orbitoides socialis*, there seems no difficulty at all in accepting these forms as Eocene. *Lepidorbitoides tibeticus* has very small equatorial cells which tend to be hexagonal, in fact it seems to be an annectant type on the road to becoming a *Lepidocyclina*, while *Lepidorbitoides polygonalis* has equatorial cells which recall the structure of *Orthophragmina*. In fact these two Tibetan species present some rather exceptional characteristics, which may well be due to the fact that they are rare Eocene forms. It remains to discuss the problematical *Delheidia haydeni*. M. Dolfus [1] argues that the species is not a *Delheidia*, and without placing the species definitely either in the Hydrozoa or the Foraminifera, proposes a new generic name, *Robertella*, after Prof. Douvillé's lamented son who was killed in the war. A Silvestri [2] identifies the Tibetan species with *Bradya tergestina*, a Danian species from Istria and Dalmatia described by Stache.[3] Stache regarded this species as belonging to the foraminifera, but Silvestri refers it to the hydrozoa. He thinks that the species *Keramospl œra murrayi* Brady,[4] is to

[1] *Revue Critique de Paléozoologie* 1917. p. 39.
[2] *Rivista ital. di Paleontologia* Vol. XXX, pp. 17-26.
[3] *Abhandl. d. k. k. geol. Reichsanst.*, Vol. XIII, Pl. VI figs 24 to 28.
[4] *Ann & Mag. Nat. Hist.*, ser 5, Vol. X, p. 242, and *Report of Chall. Exp.*, Vol. IX, p. 224.

be referred to the same genus. If the genus is still living, its presence in the Tibetan so-called Danian cannot be regarded as evidence of a Danian age, notwithstanding that it is found in the Danian of Istria and Dalmatia. It is a problematical fossil, and its relationships are not yet certain.

Reviewing the whole of the evidence, it appears that the mollusca give us overwhelming evidence in favour of an Upper Ranikot to Laki age, while the evidence of the foraminifera need not necessarily be regarded as in disagreement.

BAUXITE ON KORLAPAT HILL, KALAHANDI STATE, BIHAR AND ORISSA.

BY M. S. KRISHNAN, M.A., PH.D.(Lond.), A.R.C.S., D.I.C., *Assistant Superintendent, Geological Survey of India.*

Introduction.

THE occurrence of laterite in Kalahandi State has been known for a comparatively long time. As early as 1877, V. Ball[1] observed laterite on the Baplaimalai hill in the south-eastern part of the State. Later, T. L. Walker, in his memoir on the geology of the Kalahandi State[2], mentions that laterite is of common occurrence on the hills made up of garnet-sillimanite gneisses. Quite recently, C. S. Fox has summarised the available information on the Kalahandi laterites in his valuable memoir on "The Bauxite and Aluminous Laterite occurrences of India[3]."

Among Walker's specimens, is a pisolitic "mottled laterite" (reg. no. 15/215) reported to have been collected from the Korlapat hill, but whose exact locality is not known. An analysis of this specimen by H. Warth has been quoted by Sir T. H. Holland[4] in his paper on bauxite in India, since this specimen is a bauxite containing as much as 67 per cent. of alumina.

In April 1926, the writer was deputed to examine the Korlapat hill with regard to the occurrence of bauxite, and the results of the investigation form the subject of this note.

Communications.

The village of Korlapat (lat. 19° 41′; long. 83° 9′ 30″) is about twenty miles south of Bhawanipatna, the capital of the Kalahandi State. At the present time, the best route to Bhawanipatna is by a motor road 140 miles long, from Sambalpur, through Sonpur and Patna States. It can also be reached from Parvatipuram on the Vizagapatam side, by a route which follows the Nagavalli River valley for the greater part of its length. The Raipur-Vizagapatam

[1] *Rec., Geol. Surv. Ind.*, Vol. X (1877), pp. 169-71.
[2] *Mem., Geol. Surv. Ind.*, Vol. XXXIII, Pt. 3 (1902).
[3] *Mem., Geol. Surv. Ind.*, Vol. XLIX, Pt. 1 (1923), pp. 182-84
[4] *Rec., Geol. Surv. Ind.*, Vol. XXXII, Pt. 2 (1905), p. 179, Analysis L.

Railway, now under construction, will pass through Bhawanipatna when completed, and will then make the region easily accessible.

Korlapat hill.

The Korlapat hill extends from the village of the same name for about 8 miles in a southward direction, and forms part of the Eastern Ghat system. It is flat-topped and attains an average height of 3,800 feet. The highest point on the hill is "Korlapat S." (3,981 ft.) situated near the southern end. At its base the hill measures about a mile across. Its flanks are steep and clothed in thick vegetation; the top, which consists of a capping of laterite, is sparsely wooded, owing to the thinness of the soil-cover (about a foot on an average) and the general absence of joints and cracks where trees could take root. Numerous tiny springs issue forth from beneath the laterite cap, but on the cap itself there is scarcely any sign of water. These springs collect together at the base to form perennial streams.

Geology.

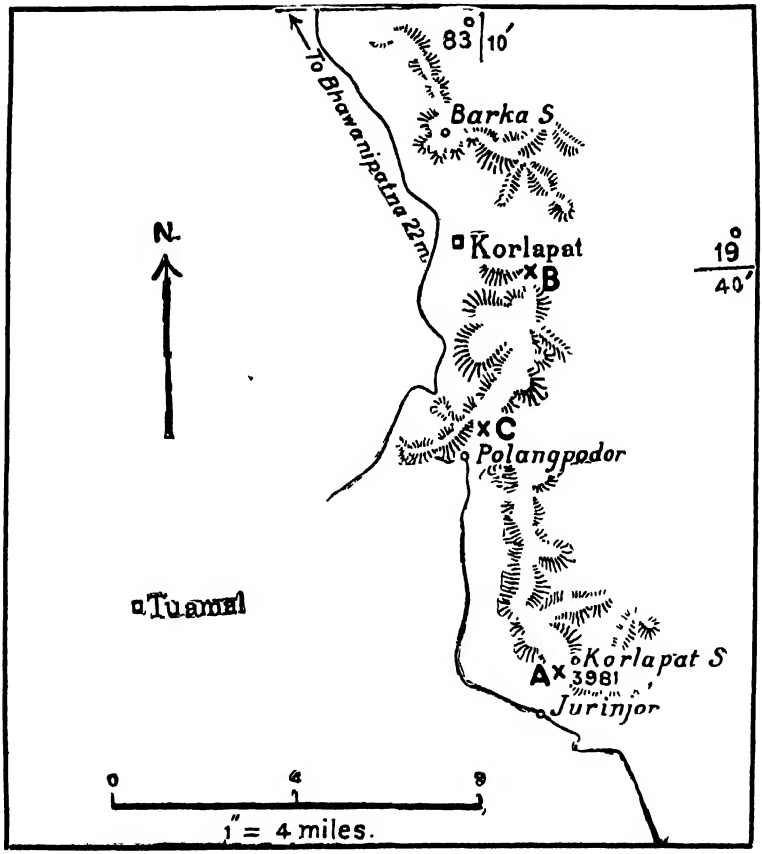
The valleys at the foot of the hill are underlain by charnockites, which range from acid to basic in composition (reg. nos. 35/46, 35/28, 35/29), while garnetiferous varieties are not uncommon. The hill itself is composed of quartz-garnet-sillimanite-graphite schist, to which Walker has given the name "khondalite"[1] (reg. no. 35/30). All these rocks have a strike which varies from N.-S. to N.N.E.-S.S.W., the latter direction being the more common. The hill-slopes are made up of kaolinised khondalite, excepting a thickness of 60-150 feet at the top, which is all laterite. The kaolinised khondalite (reg. nos. 35/31, 35/32, 35/35, 35/37, 35/41) is a soft friable rock mottled with patches of red and brown, which represent weathered garnet. The laterite is red and ferruginous (reg. nos. 35/38, 35/39) for a depth of some ten feet at the very top, while below it comes a more aluminous and lighter coloured variety. Often, instead of the aluminous laterite, we observe a continuation of the same material as at the top, or a siliceous modification of it (reg. no. 35/40) extending downwards.

Bauxite.

East of the village of Polangpodor (lat. 19° 37′; long. 83° 9′ 30″) the ferruginous laterite at the top of the western flank changes to a yellow material (reg. no. 35/392) at about ten feet lower down. It has

[1] *Mem., Geol. Surv. Ind.*, Vol. XXXIII, Pt. 3 (1902), pp. 8-11.

a vertical thickness of 15 feet—*i.e.*, 10 to 25 feet below the top—and a horizontal extent of about 450-500 feet. How far it extends into the body of the hill is not known, and at the corresponding position on the eastern flank there is no indication of similar material.



Below are given analyses of three specimens (A, B and C) taken from different parts of the hill, one of these being a sample of the yellow-coloured rock mentioned above; it will be seen that this is

bauxite of good quality. The analysis of the specimen collected by Walker is also added for comparison (Analysis D).

	A.	B.	C.	D.
Al_2O_3	39·69	25·84	61·92	67·88
Fe_2O_3	2·24	8·86	4·44	4·09
SiO_2	45·14	53·93	2·30	0·93
TiO_2	trace	2·59	2·77	1·04
CaO	1·07	0·16	0·09	0·36
MgO	0·15	trace	trace	..
H_2O (at 106° C)	0·76	0·68	1·14	26·47
H_2O (above 106° C)	11·65	8·45	27·51	
TOTAL	100·70	100·51	100·17	100·77

A. From the southern end of the Korlapat hill (reg. no. 35/42). Analyst M. S. Krishnan.

B. From the northern end of the Korlapat hill (reg. no. 35/35). Analyst M. S. Krishnan.

C. From the Korlapat hill, east of Polangpodor (reg. no. 35/392). Analyst M. S. Krishnan.

D. From the Korlapat hill (reg. no. 15/215). Analyst H. Warth (*Rec. Geol. Surv., Ind.*, Vol. XXXII, pt. 2 (1905), p. 179. Analysis L).

The streams flowing over the flanks and at the foot of the Korlapat hill give no indication of bauxite, transported or *in situ*, and there are no stream-courses on the top of the hill to reveal any vertical sections of the laterite. It appears therefore unlikely, except for the band east of Polangpodor, that there is any rich deposit of bauxite on this hill, so far as can be gathered from surface observations, and in the case of this band, its extent, richness, and variation of quality from place to place, can be decided only by carrying out regular prospecting operations.

INDEX TO RECORDS, VOLUME LIX.

MGIPC—M—V 2 12—28 3-27- 800.